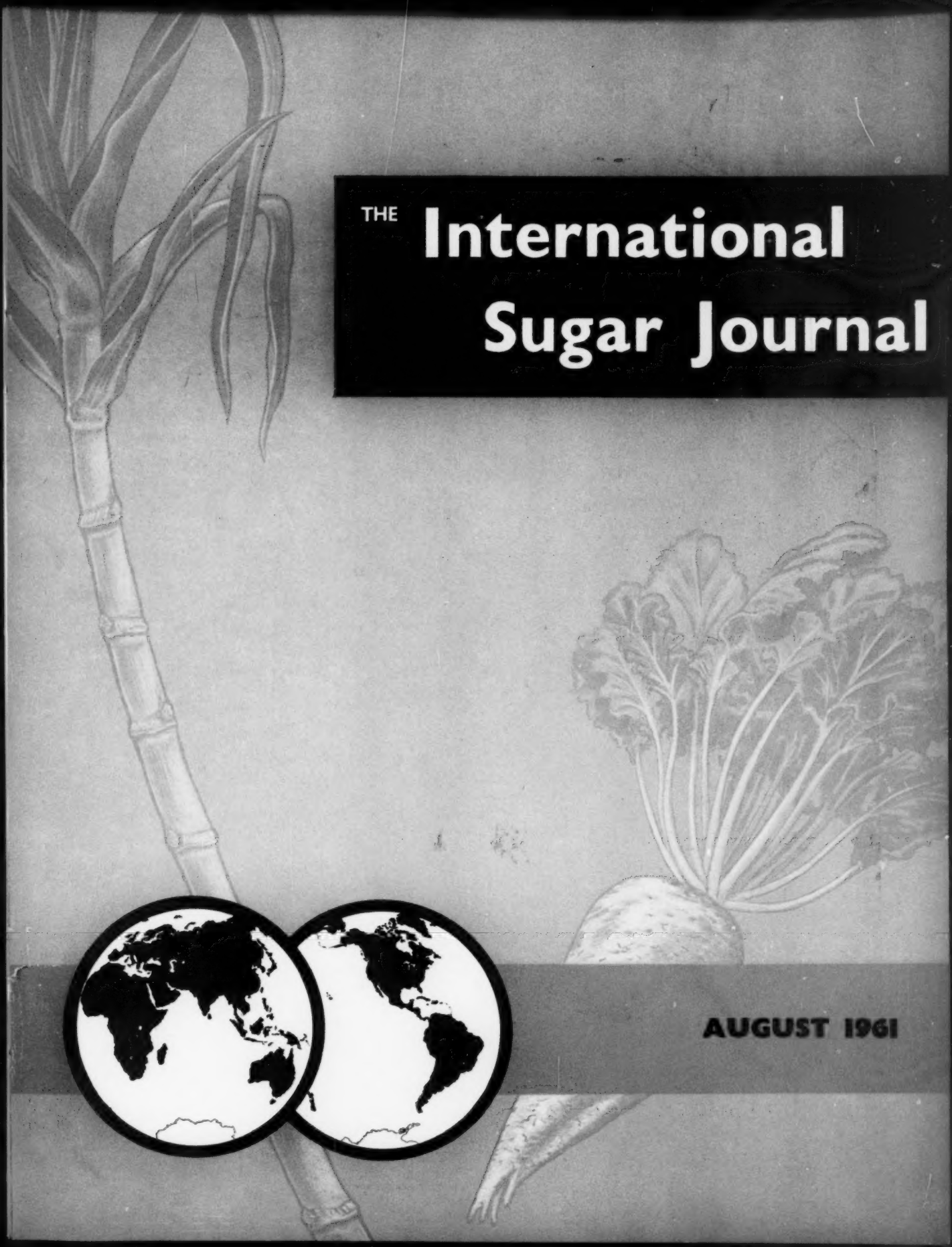


THE International Sugar Journal

AUGUST 1961

BLAIRS

this Symbol guarantees High Quality, Efficient Performance, Reliability and Long Life in Sugar Machinery

QUICK BOILING PANS FOR WHITE SUGAR

Our illustration shows two 10' 0" diameter Vacuum Pans each with a heating surface of 1190 square feet. These pans embody some outstanding features—Calandrias baffled to ensure an even distribution of steam efficient extraction of incondensable gases, effective drainage and entrainment prevention.

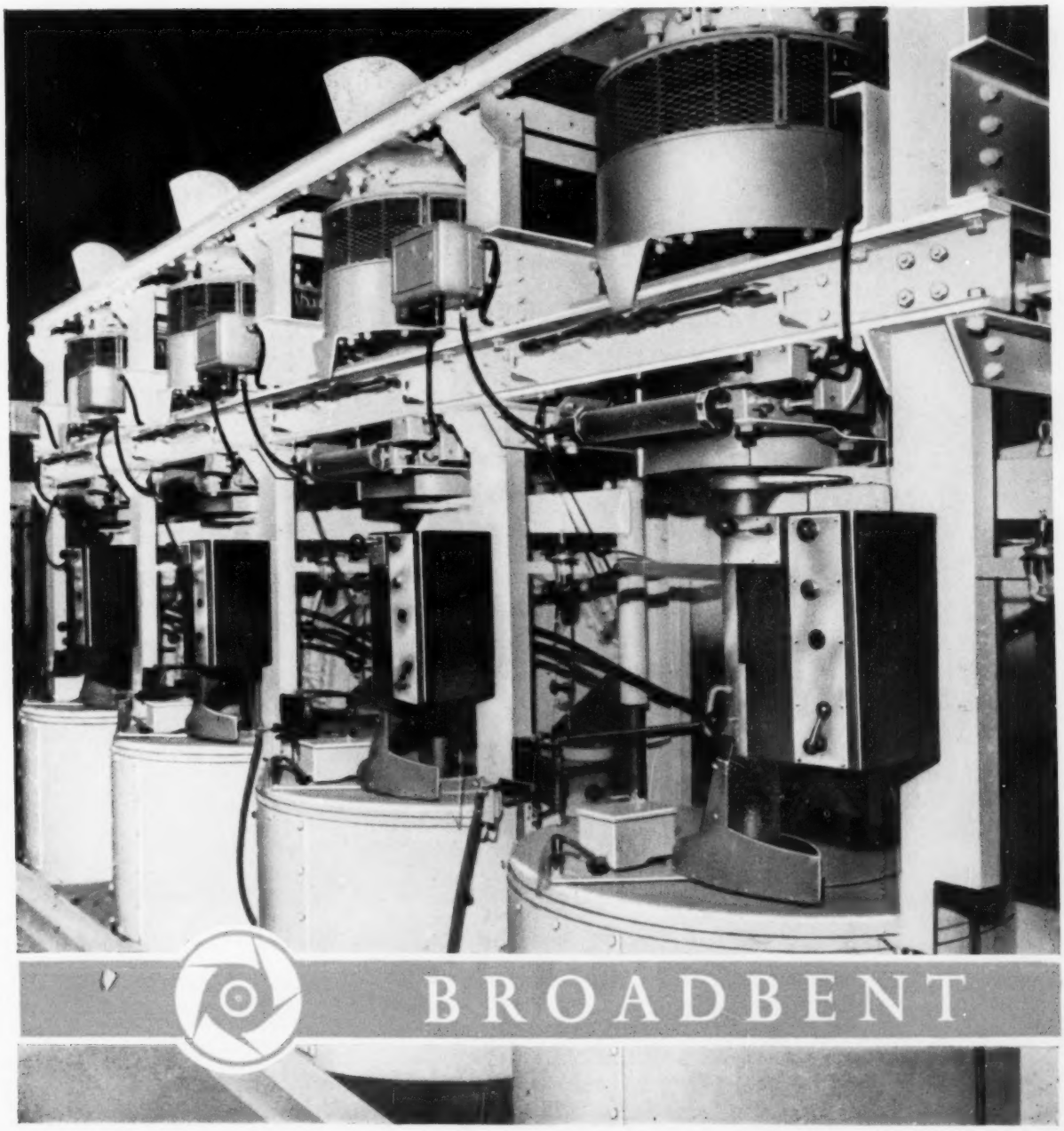
BLAIRS LIMITED

WOODVILLE STREET, GLASGOW, S.W.1. *Cables:* "Blazon Glasgow"

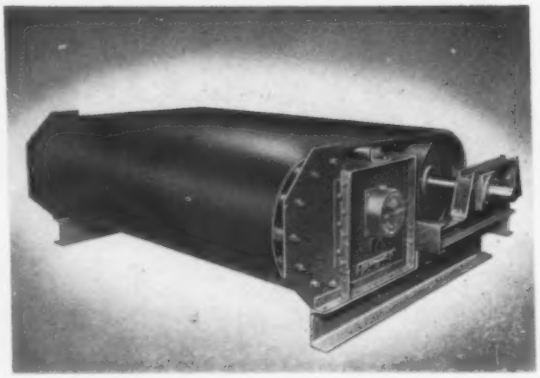
London Office: 38 Grosvenor Gardens, S.W.1. *Cables:* "Multivap, Sowest, London"

At Big Bend Factory, Swaziland, a battery of 42 in. × 30 in. 1500 r.p.m. centrifugals for curing low grade massecuites. We also supplied the "A", "B" and refined white massecuite centrifugals with associated battery equipment for the new factory.

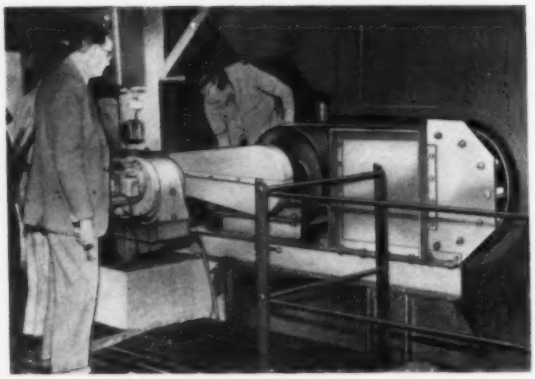
THOMAS BROADBENT & SONS LTD.
HUDDERSFIELD **ENGLAND**



MAGNETIC CONVEYOR HEAD



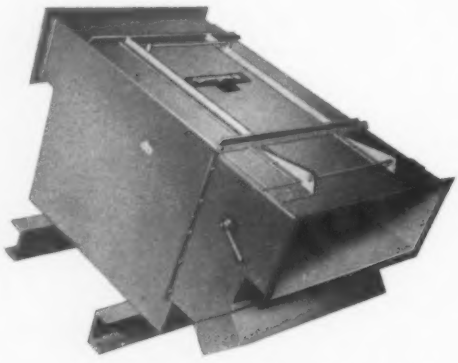
Boxmag patent MH. 2484. Conveyor Head built into an 84" wide short belt conveyor, photographed prior to despatch. The machine is designed for installation, as shown on the adjacent illustration.



Boxmag patent MH. 2484 installed in the chute between a sugar cane carrier and crusher, at a factory in Mauritius. It is designed to remove tramp metal automatically and continuously without an operator's attention. (write for leaflet 62/2).

MAGNETIC SEPARATORS PROTECT MACHINERY AND PRODUCTS

(Write for further details)



Boxmag Superflux Magnetic Chute for removal of ferrous contamination from refined sugar to decontaminate the product.

A Boxmag Unimajor block type Permanent Magnet. One of the many types of separators suitable for general applications in sugar factories. (write for details of full range).

BOXMAG

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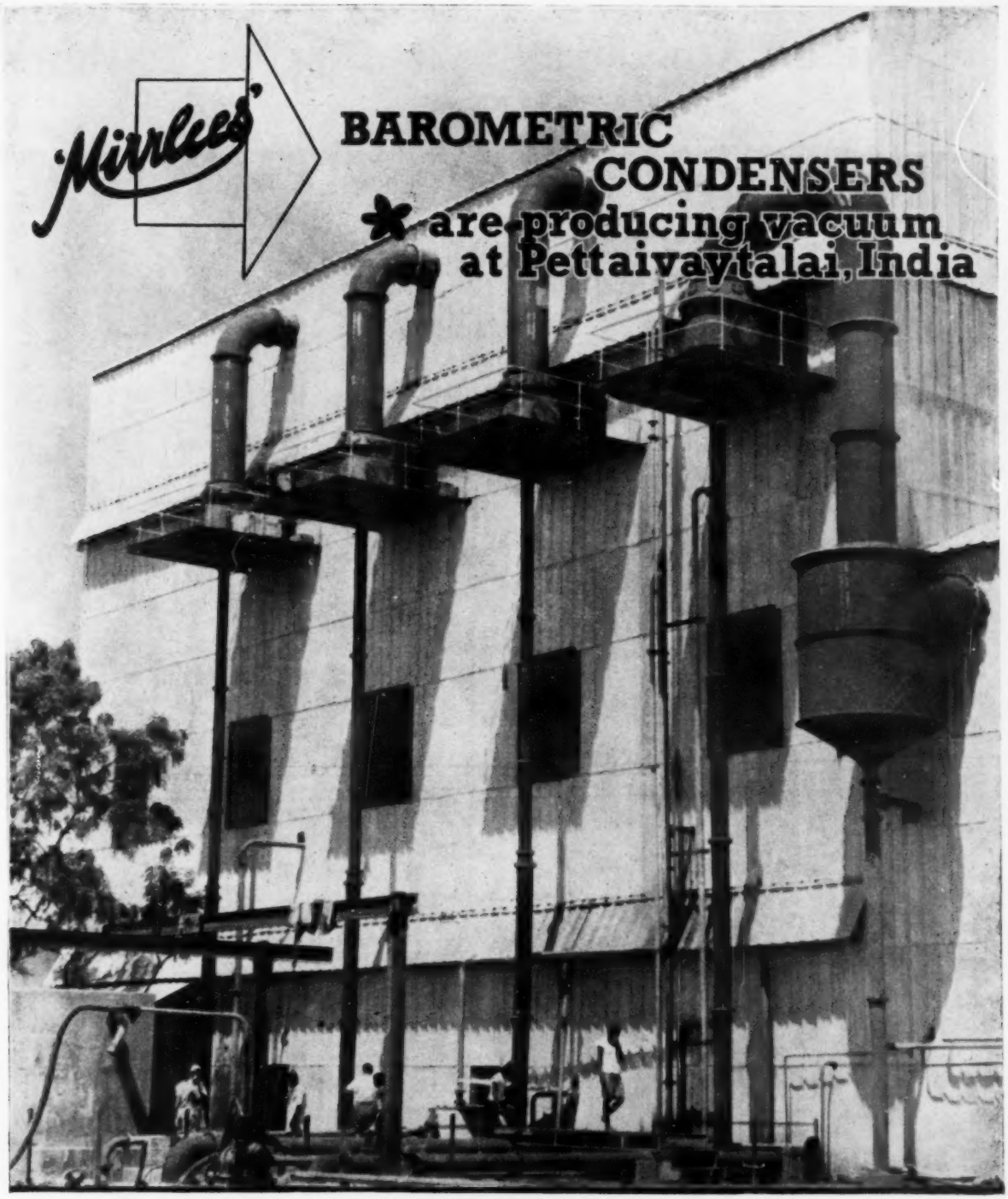

vacuum without moving parts

For Factories with suitable water conditions Mirrlees Barometric Condensers, having no mechanically moving parts, produce vacuum with trouble-free operation and little or no maintenance.

Of the three types of Barometric Condensers manufactured by Mirrlees, the Multi-Jet Spray is shown installed at Pettaivaytalai. The other types are Multi-Jet and Counter Current Tray.

THE MIRRLEES WATSON COMPANY LIMITED

HEAD OFFICE AND WORKS—45 SCOTLAND STREET, GLASGOW, SCOTLAND CABLES: "MIRRLEES GLASGOW"
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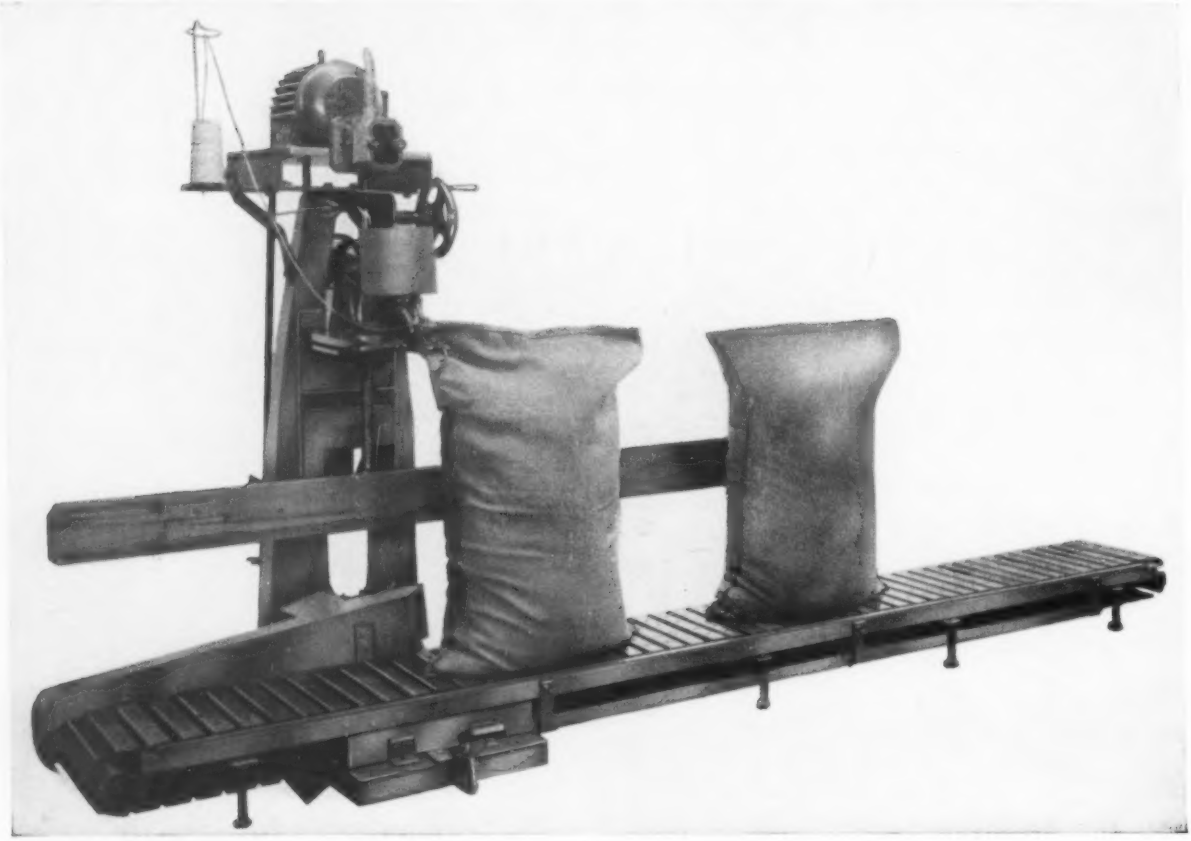
The 'Super' Universal Sack Closing Machine

MODEL NO. 5B

Fitted with 10 or 12 ft. Conveyor and Special Clutch Drive



This machine is fitted with a conveyor 10 or 12 ft. overall and a Special Clutch Drive which allows the conveyor to be run independently of the sewing head.

Jute, Hessian, Paper Lined Hessian, Cotton and Paper Sacks weighing from 50 to 325 lbs. can be sewn on this machine.

Machines can be seen working by appointment.

Power required 2 h.p. *Shipping weight : 14 cwts.*

Manufactured in Great Britain by :

The Sack Filling & Sewing Machine Syndicate Limited

(Timewell's Patent)

TIMEWELL WORKS · LOCKFIELD AVENUE · BRIMSDOWN · ENFIELD . MIDDX.

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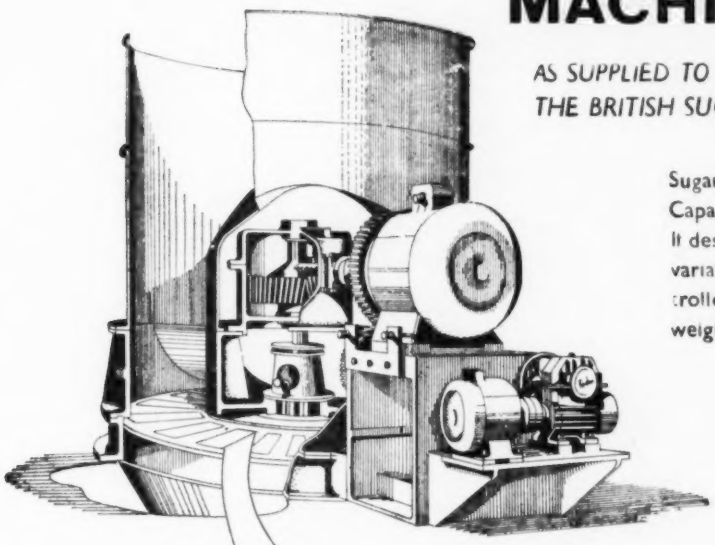
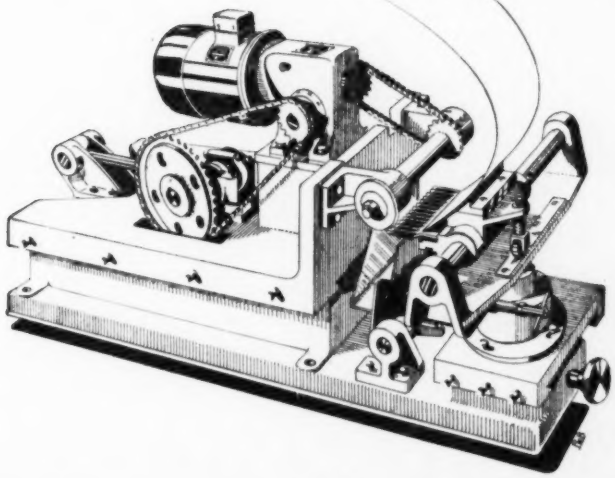
BEET SLICING
and
AUTOMATIC KNIFE SHARPENING MACHINES

AS SUPPLIED TO
THE BRITISH SUGAR CORPORATION LTD



Sugar Beet Slicing Machine. Capacity 1,200 tons/24 hrs. If desired can be fitted with variable speed drive controlled by cossette band weigher.

Automatic Knife Sharpening Machine for coarse and fine sharpening.



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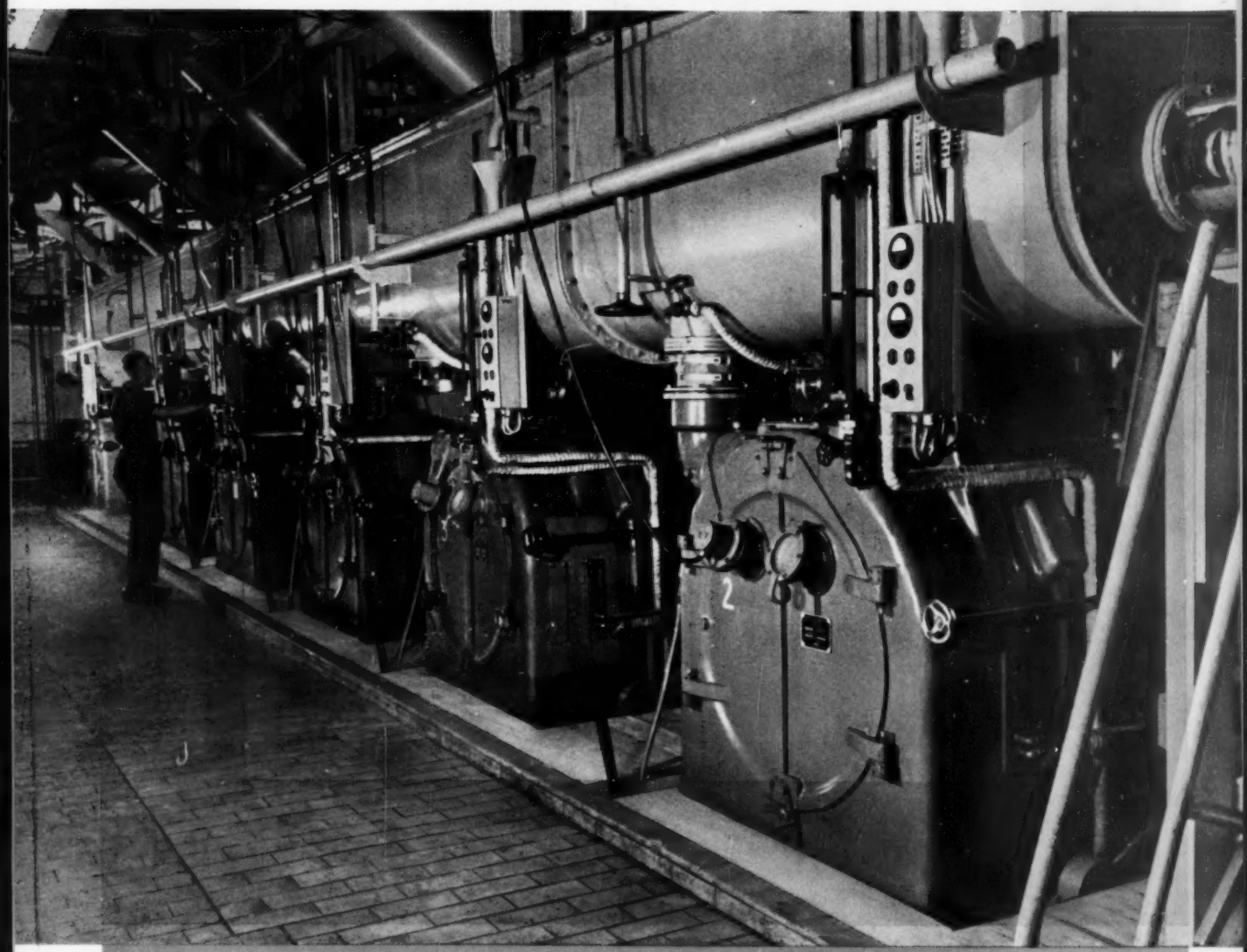
WORKS: STAFFORD · PRESTON · RUGBY · BRADFORD · LIVERPOOL · ACCRINGTON

5.42

ESCHER WYSS

continuous centrifuges for the sugar industry

A battery of six push-type centrifuges, Model C 4 for medium-product sugar and affinated low-grade sugar, installed at Groningen Sugar Factory / Holland



Escher Wyss Ltd., Zurich/Switzerland
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Fully automatic!

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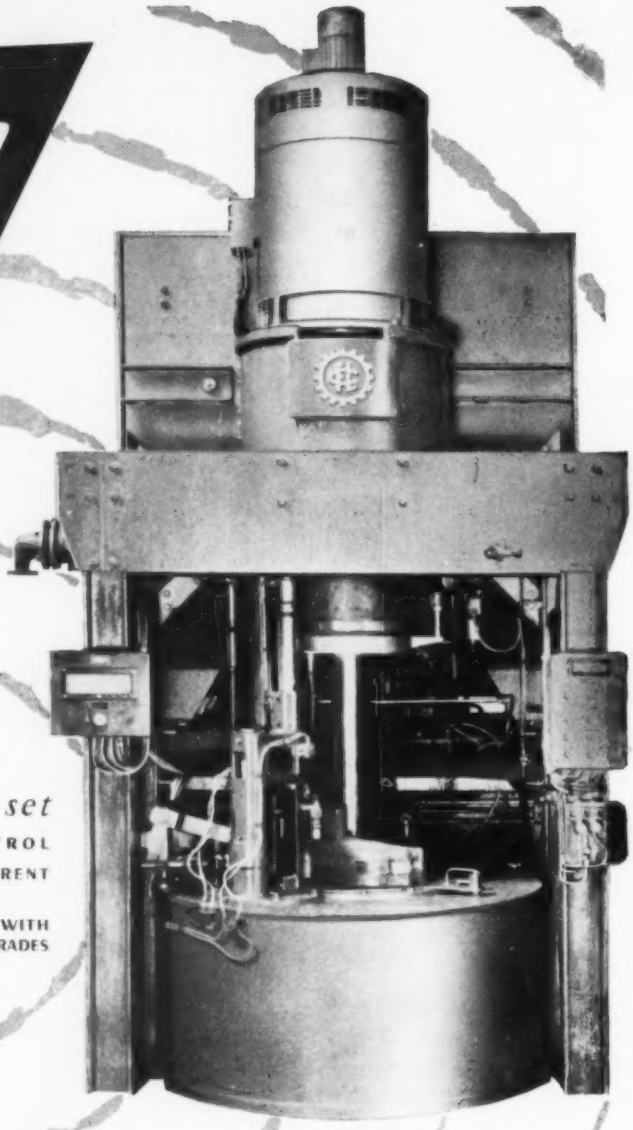
CENTRIFUGAL



driven by
WARD-LEONARD *set*

- ELECTRONIC CONTROL
- ELIMINATION OF CURRENT PEAKS
- RECORD PRODUCTION WITH MASSECUITES OF ALL GRADES

Battery of 4 centrifugals at the Fontaine-le-Dun Sugar Factory (France)

S.A.G. - PARIS

FIVES LILLE - CAIL

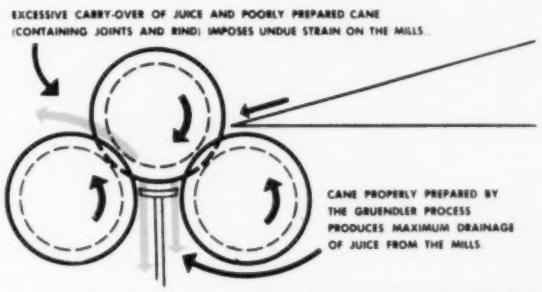
7, rue Montalivet, PARIS (8e) - Tél.: ANJou 22-01 et 32-40

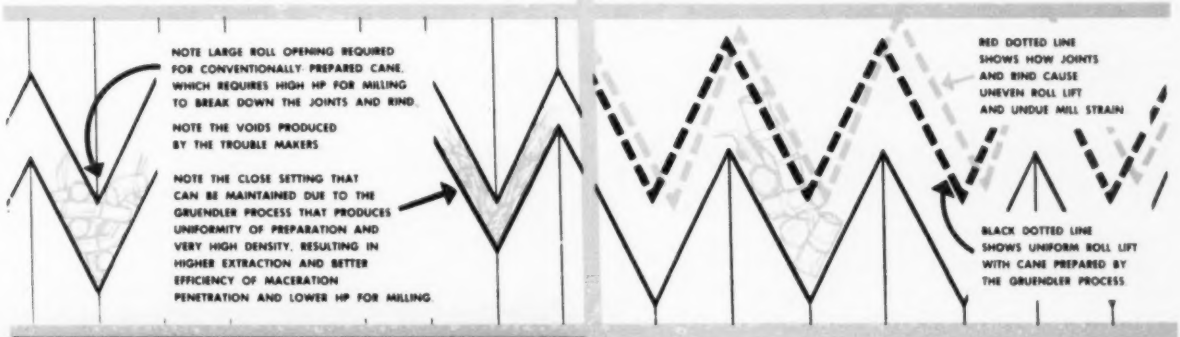
TROUBLE MAKERS IN CANE MILLING

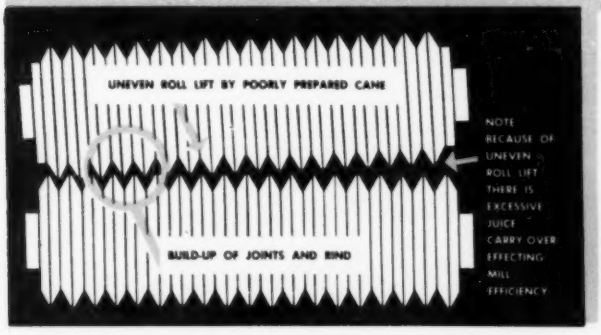
Actual photo of cane prepared by the double-knife process. First knife was set 12" above the carrier and the second knife 1" above the carrier. Notice the preponderance of trouble makers: joints, splinters and rind.

The most satisfactory milling of cane cannot be attained by double knifing of the cane alone. Many trouble makers are apt to develop, as shown by the sketches below.

By comparison, the Gruendler Process of shredding reduces voids, increases cane density and completely processes the joints and rind . . . so that the mill has only the function of rolling the juice out of the cane.


EXCESSIVE CARRY-OVER OF JUICE AND POORLY PREPARED CANE (CONTAINING JOINTS AND RIND) IMPOSES UNDUE STRAIN ON THE MILLS.
CANE PROPERLY PREPARED BY THE GRUENDLER PROCESS PRODUCES MAXIMUM DRAINAGE OF JUICE FROM THE MILLS.


NOTE LARGE ROLL OPENING REQUIRED FOR CONVENTIONALLY PREPARED CANE, WHICH REQUIRES HIGH HP FOR MILLING TO BREAK DOWN THE JOINTS AND RIND.
NOTE THE VOIDS PRODUCED BY THE TROUBLE MAKERS
NOTE THE CLOSE SETTING THAT CAN BE MAINTAINED DUE TO THE GRUENDLER PROCESS THAT PRODUCES UNIFORMITY OF PREPARATION AND VERY HIGH DENSITY, RESULTING IN HIGHER EXTRACTION AND BETTER EFFICIENCY OF MACERATION PENETRATION AND LOWER HP FOR MILLING.
RED DOTTED LINE SHOWS HOW JOINTS AND RIND CAUSE UNEVEN ROLL LIFT AND UNDUE MILL STRAIN
BLACK DOTTED LINE SHOWS UNIFORM ROLL LIFT WITH CANE PREPARED BY THE GRUENDLER PROCESS


UNEVEN ROLL LIFT BY POORLY PREPARED CANE
BUILD-UP OF JOINTS AND RIND
NOTE BECAUSE OF UNEVEN ROLL LIFT THERE IS EXCESSIVE JUICE CARRY OVER EFFECTING MILL EFFICIENCY

THE GRUENDLER CANE SHREDDING PROCESS ALWAYS PREPARES CANE PROPERLY

- **Increases capacity**
- **Increases sucrose extraction**
- **Reduces bagasse moisture**
- **Reduces mill strain**
- **Eliminates most tramp iron**
- **Lowers steam requirements**

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Farrel rubber-belt carriers

proven cleaner, more durable in installations since 1952

54 installations since 1952 have proven Farrel rubber-belt intermediate carriers definitely superior to the conventional chain and slat type. Reports from users indicate that maintenance of these simple units is almost unheard of, operation is cleaner and retention of bagasse and imbibition better.

The first of these carriers, for example, was installed at Central Plata, Puerto Rico, in 1952. It was used for 6 crops in grinding 2½ million tons of cane. According to chief engineer Rafael Labiosa, "Not a single minute has been lost due to mechanical failure of the rubber belt and the rest of the components of its units." The belt, which is still in usable condition, is now carried as a spare.

The performance of the belt is all the more amazing when you consider that it had only 1/16" rubber covering on the carrying side. Subsequent units supplied by Farrel have a 1/8" rubber coating.

Farrel's patented carrier has been designed for easy replacement of a slat carrier during a short shut-down. The endless rubber belt has rubber cleats on the top every six inches for better mill feed.

Send for a quotation covering your requirements.

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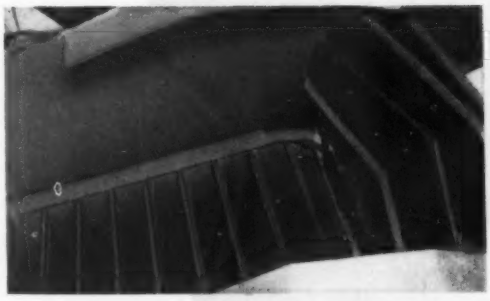


One of the Farrel rubber-belt carriers in operation at Central Plata, Puerto Rico.

FARREL®

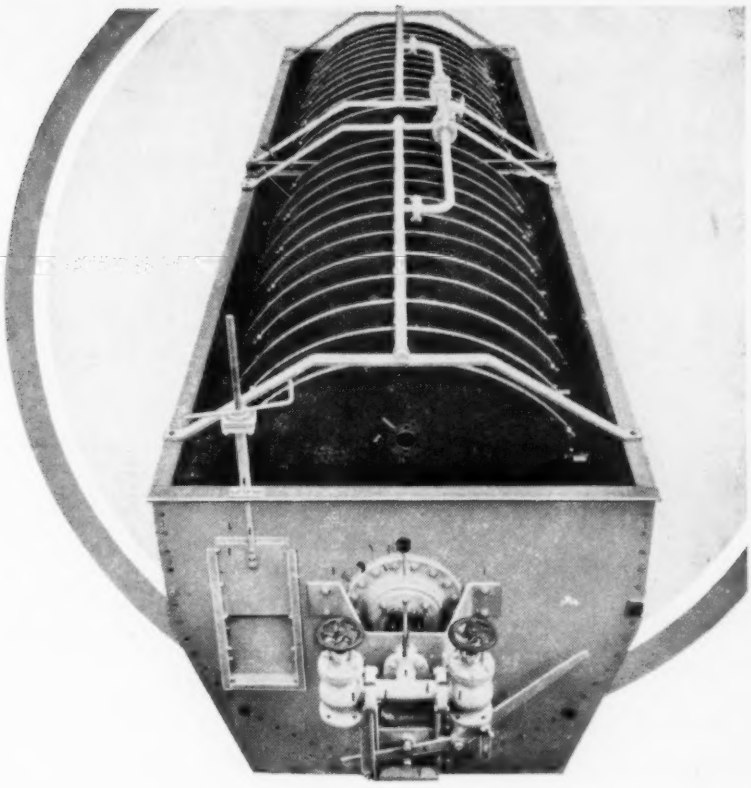
More than 500

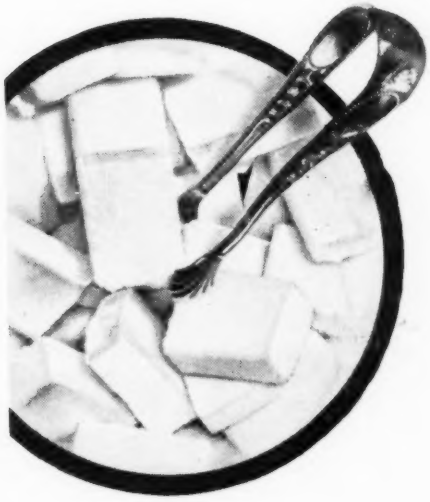
WERKSPOOR

Rapid Crystallizers

in use in

sugar factories





Applications for high grade as well as for LOW GRADE massecuites!

Licensees for the manufacturing of Werkspoor Rapid Crystallizers:

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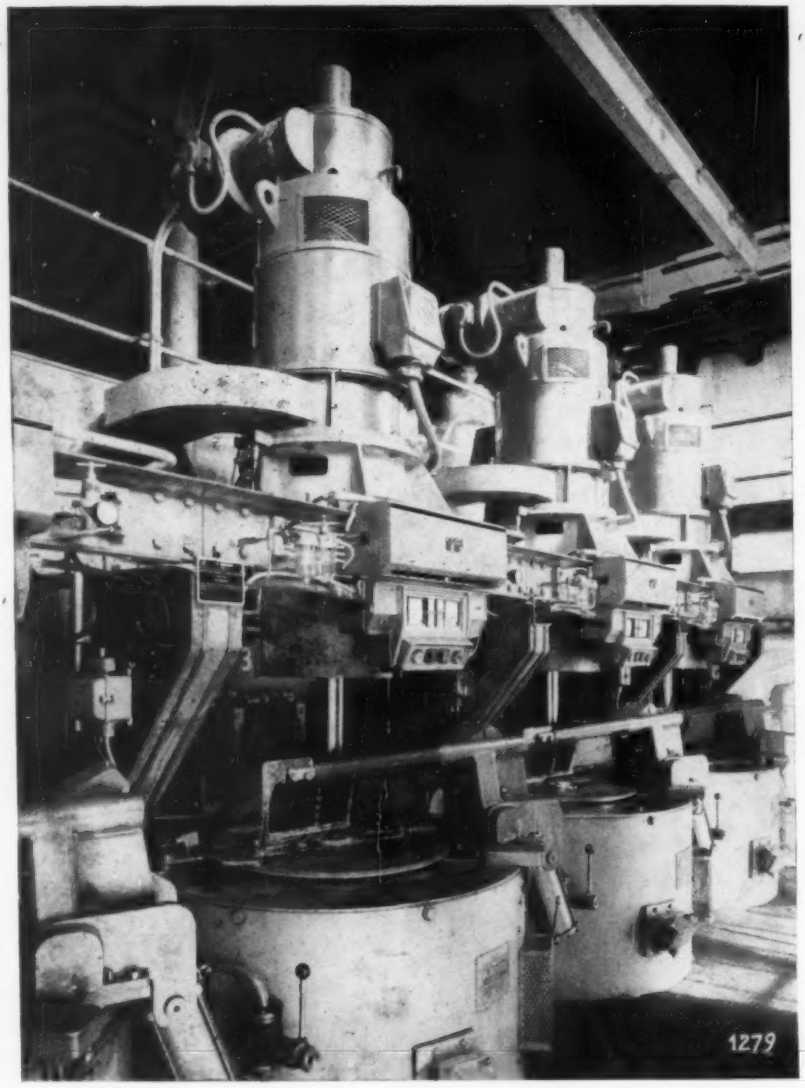
Since it was established in 1890, our Company has manufactured machinery for the sugar industry, and for more than forty years has specialized in constructing centrifugals.

Our Technical Service is continually developing machines which incorporate improvements designed to meet the technological requirements of new and varying processes in the sugar industry, taking into account the demands of the European Common Market. These new centrifugals are distinguished for their high grade of *standardization* and for their low cost both from the point of view of the purchase price and running costs.



FULLY AUTOMATIC SUGAR CENTRIFUGALS

Type	*Basket D × H*	*Basket cross section*	*Massecuite Max. Charge*	*Performances*		
				Mod.	*Max. sp. r.p.m.*	*Cycles per hr.*
"SCARA. U"	1250 × 830 mm.	Cylindrical with truncated cone shaped bottom	500 kg.	Normal	1000	30
				Velox	1500	25
"SCAME. P"	1050 × 585 mm.	Cylindrical with flat bottom	350 kg	Normal	1500	20
				Velox	1800	10
"SCAME. G"	1220 × 762 mm.	Cylindrical with flat bottom	650 kg.	Normal	1000	25
				Velox	1500	20

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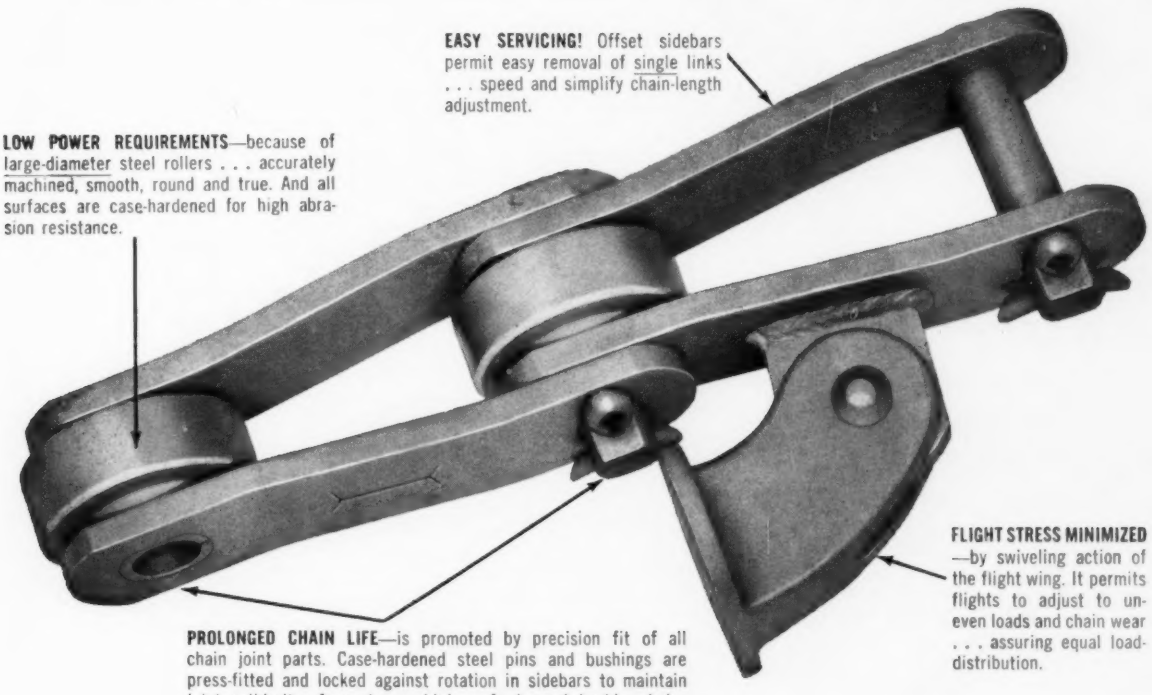
TERNI **ITALY**

Get the long-life chain made for long-center bagasse carriers ...Link-Belt SS-2184 Plus chain

EASY SERVICING! Offset sidebars permit easy removal of single links . . . speed and simplify chain-length adjustment.

LOW POWER REQUIREMENTS—because of large-diameter steel rollers . . . accurately machined, smooth, round and true. And all surfaces are case-hardened for high abrasion resistance.



FLIGHT STRESS MINIMIZED—by swiveling action of the flight wing. It permits flights to adjust to uneven loads and chain wear . . . assuring equal load-distribution.

PROLONGED CHAIN LIFE—is promoted by precision fit of all chain joint parts. Case-hardened steel pins and bushings are press-fitted and locked against rotation in sidebars to maintain joint solidarity. Accurate machining of pin and bushing holes assures correct pitch. Pins can be arranged for pressure lubrication of joint parts to further minimize wear.

Here's bagasse-carrier chain designed specifically for all the grueling requirements of heavy-duty, long-center, high-load-capacity carriers. Link-Belt all-steel SS-2184 PLUS has an average ultimate strength of 60,000 lbs. . . . fights wear with hardened surfaces on all joint parts. This built-in strength assures continuous high production and reduced operating costs.

For any bagasse carrier application, you'll find Link-Belt has the chain *best-suited* to your specific requirements. For example, Link-Belt 1100 malleable or Promal chains are ideal for bagasse carriers having shorter centers, and lighter loads. For further details, contact your Link-Belt representative. Or write direct for Book 2640 covering *all* Link-Belt sugar-mill chains and supplementary equipment.

FOR SHORTER BAGASSE CARRIERS, Link-Belt 1100 Series roller chains are the perfect choice. Available in durable malleable iron or in Promal—a pearlitic malleable iron with about 25% more strength and greater resistance to abrasive wear.

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place at your disposal
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The resources of Yorkshire Imperial Metals Limited are devoted solely to the manufacture of non-ferrous tubes, plates and fittings, and plastic tubes and fittings. They have long been intimately associated with the Sugar Industry, both at home and overseas, and have made a careful study of the varied and often arduous operating conditions which obtain in the Industry. This study has resulted in the development of improved tube and plate alloys, metallurgically designed and scientifically manufactured to give the best possible service. This unrivalled experience is at your service, free of charge and without obligation, to assist in the solution of problems of all kinds affecting the life and use of non-ferrous tubes and plates.

Yorkshire Imperial craftsmanship, metallurgical skill and specialised experience, together with modern plant and methods and accurate control at every stage of manufacture, account for the enviable reputation which *Yorkshire Imperial* tubes and plates and *Yorkshire Imperial* fittings have achieved in their respective fields.

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The Crystalloscope is an instrument designed for controlling and improving the process of sugar boiling. It also finds application in some fields of the pharmaceutical and chemical industries.

CRYSTALLOSCOPE

The Crystalloscope revolutionizes the conventional process of sugar boiling by dispensing with the use of sampler tap, and increasing the economy of sugar production by 15%.

The high efficiency involved in its use makes the Crystalloscope suitable for checking the process of preparing primary, intermediate and final products as well as refinements.

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TRIPLE CHECKING SYSTEM

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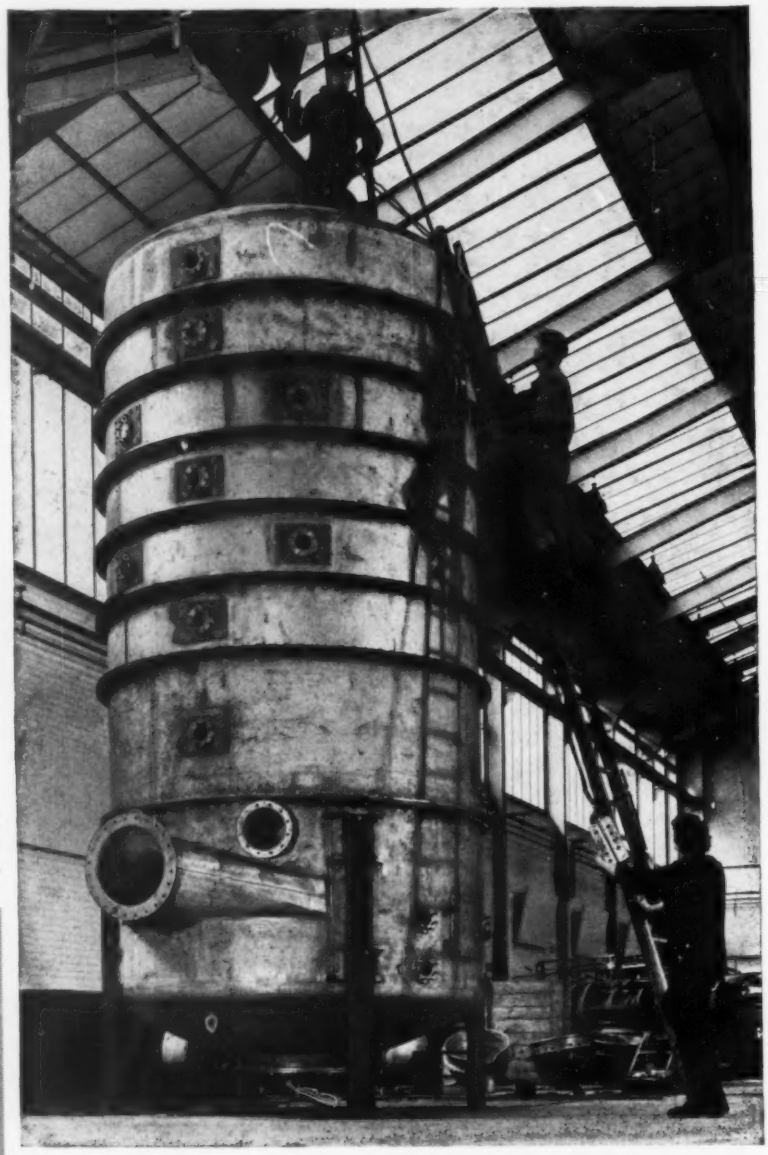
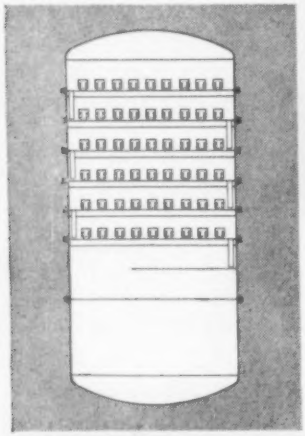


STAINLESS STEEL ABSORPTION COLUMN 8' DIAMETER 26' OVERALL HEIGHT



By welding a century's experience of fabricating work with today's most modern methods and equipment, Clarks come nearer than most to giving their customers everything they want. Contact Clarks for the **practical** approach to your next job!

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METALLIC ARC WELDING
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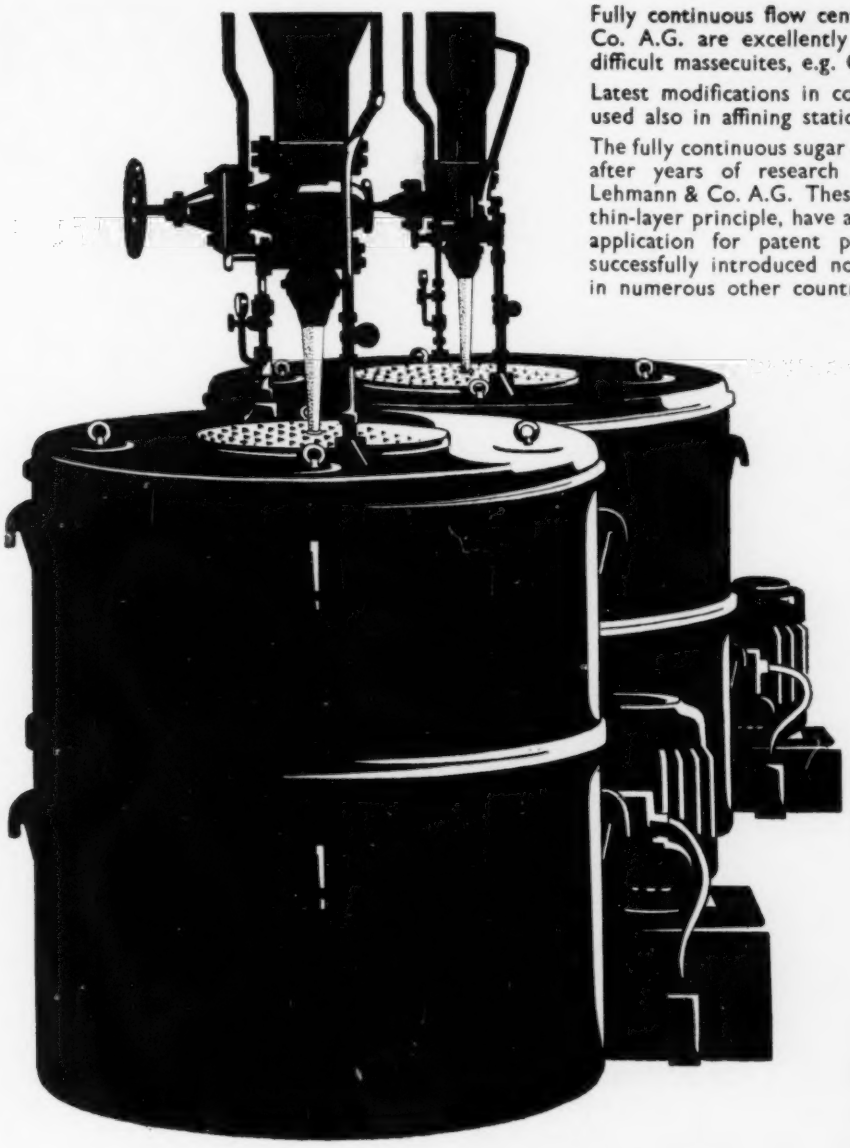

Fully continuous flow centrifugals of Hein, Lehmann & Co. A.G. are excellently suitable for curing of most difficult massecuites, e.g. C-, final or second product.

Latest modifications in construction allow them to be used also in affining stations.

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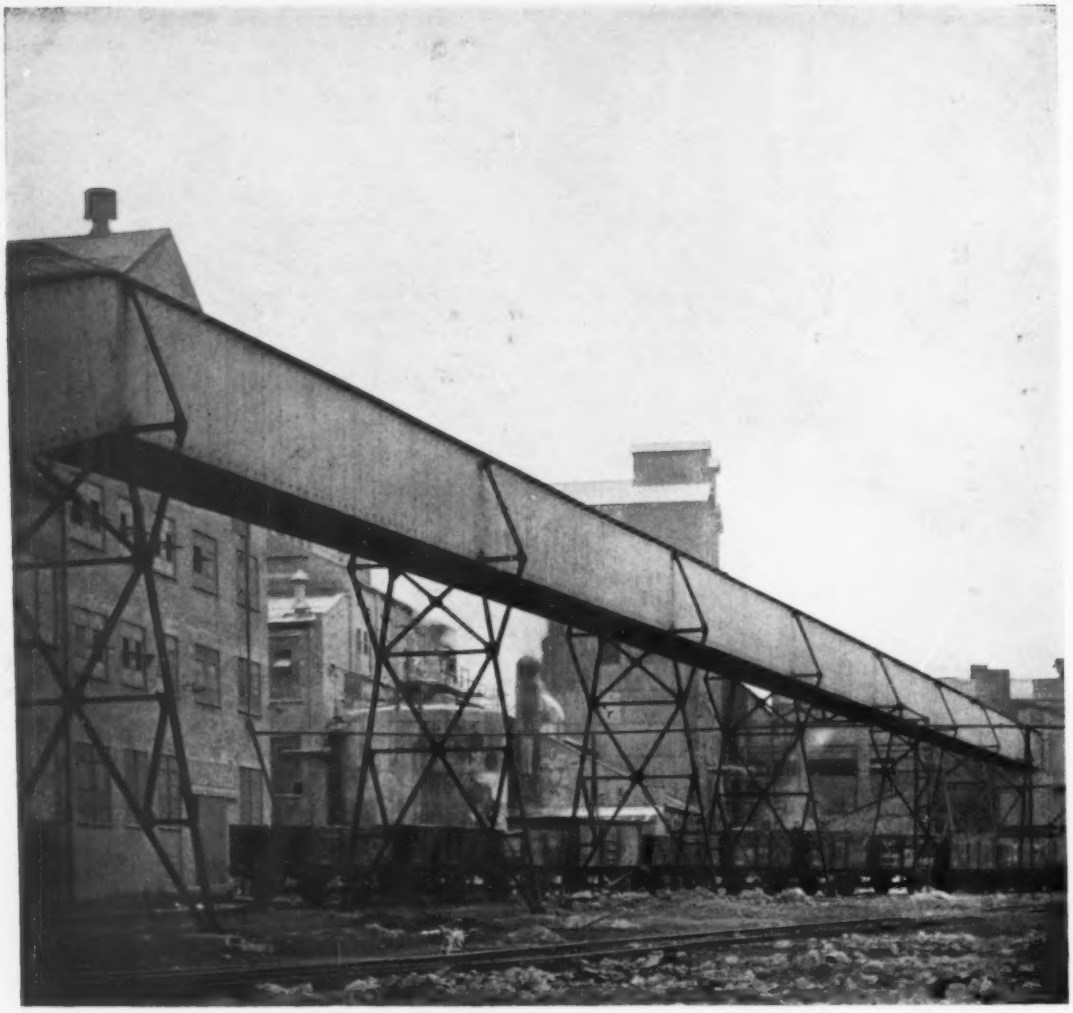

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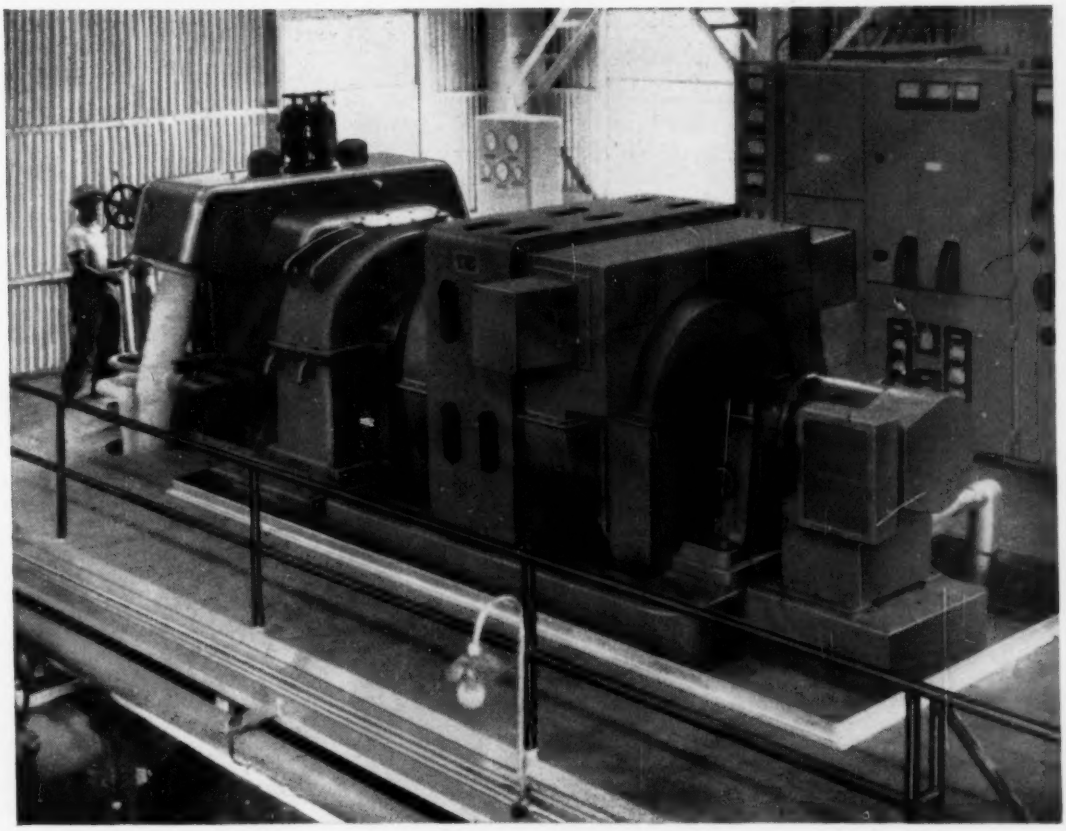

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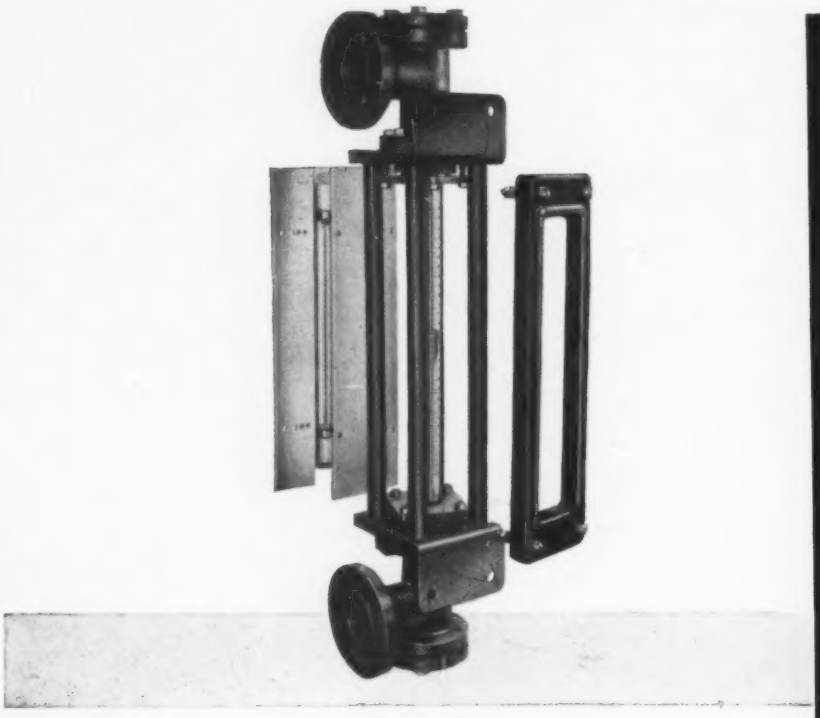

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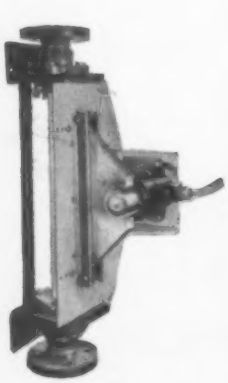

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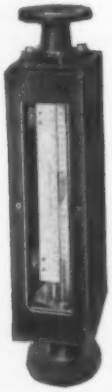

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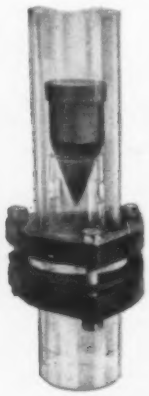

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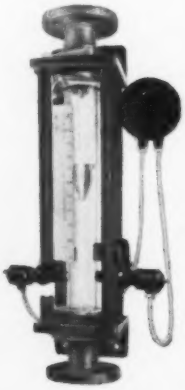

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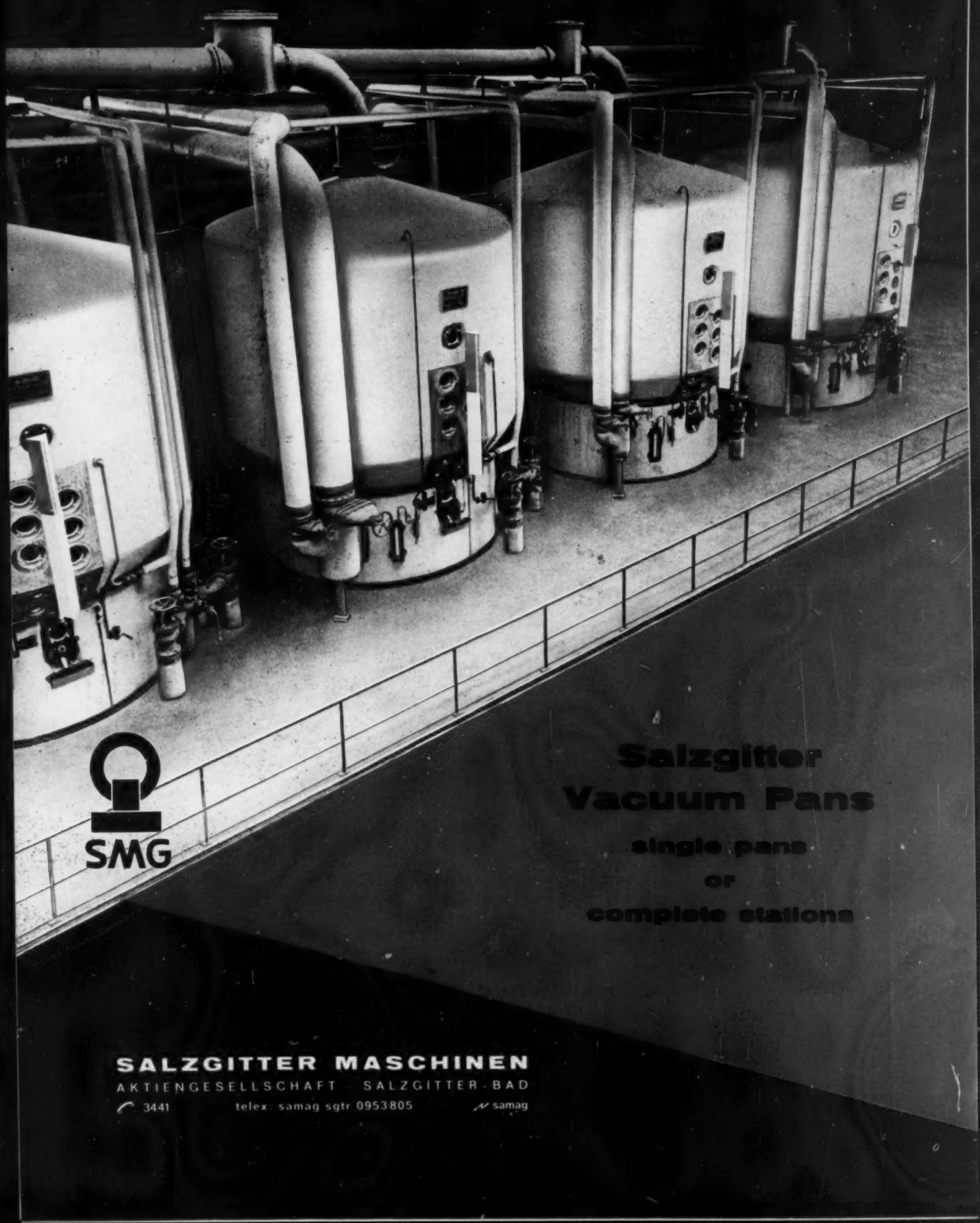

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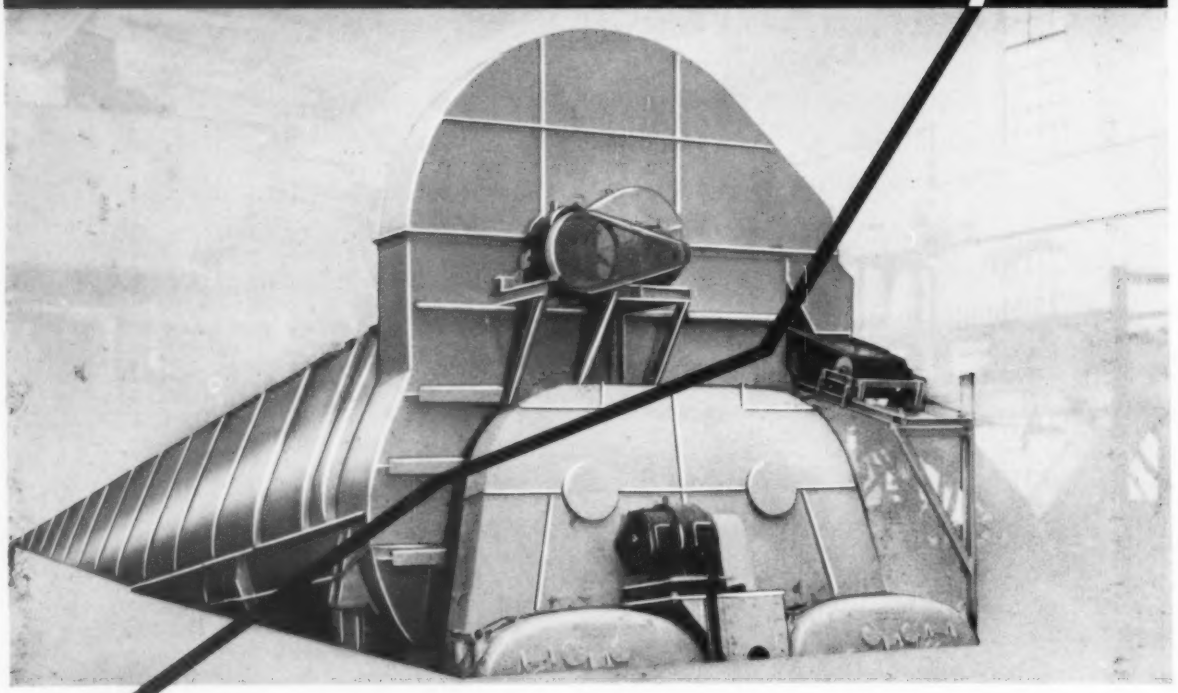

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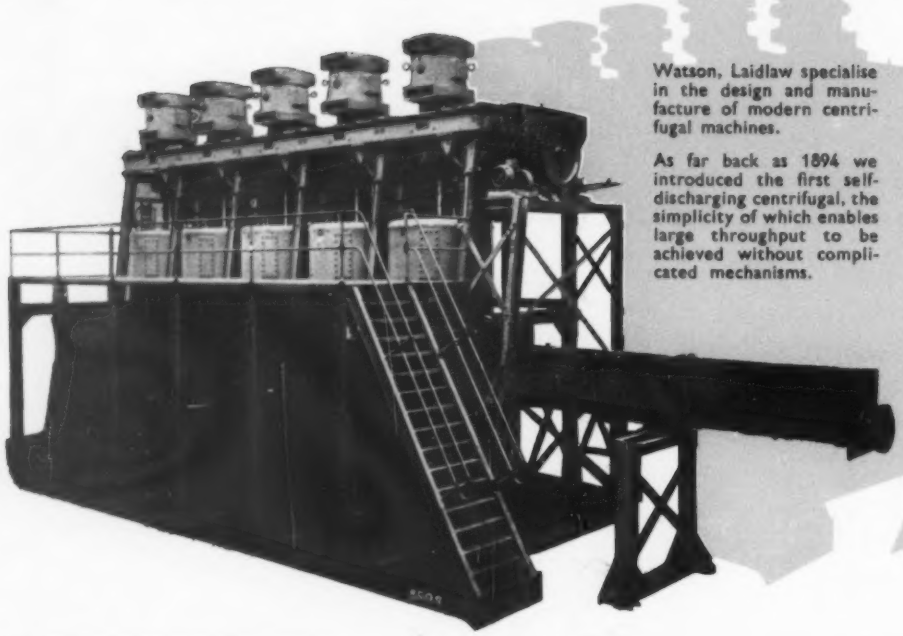

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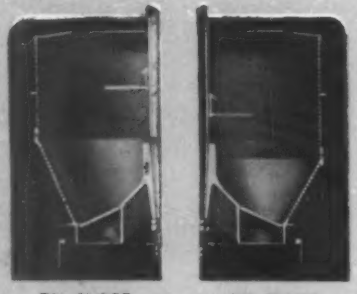

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THE
INTERNATIONAL SUGAR JOURNAL

VOL. LXIII AUGUST, 1961 No. 752

NOTES AND COMMENTS

British Sugar Corporation Ltd. Report, 1960/61.

The yield of 7,215,261 tons from the 1960/61 sugar beet crop was a new record for this country. It was over two million tons higher than the average of the previous five years, and almost one-and-a-half million tons above the highest figure previously recorded in 1958/59. In all but two factory areas the yield of beet per acre was an all-time record. The highest yield per acre so far achieved was obtained by the growers at Ipswich factory, with 19·73 tons of beet per acre. The average yield for the whole country was 17·37 tons per acre, being 3·5 tons higher than the yield of 1958/59. The total sugar yield per acre was 52 cwt compared with the previous highest of 45·3 cwt.

The dry weather of March and April, 1960, encouraged early sowings and three-quarters of the acreage was sown by mid-April. The early sowings germinated well, resulting in higher than normal plant populations. From July to November rainfall of the country as a whole was the highest since 1927 with a total of 26·85 inches, which is 57·5% above the average. Under the virus yellows control scheme, half the acreage was sprayed with systemic insecticide, which, together with the heavy rains, kept the crop growing and prevented the spread of aphids, so that it was relatively free from pests or disease.

Root weights were particularly high, but sugar contents were depressed to around 14·97%. Excessive rain during the autumn made harvesting and delivery extremely arduous and it was only by good fortune with the weather in 1961 that the vast quantity of beet was so successfully delivered.

Production figures for all products were the highest on record. Sugar production, consisting of 592,775 tons of white and 311,890 tons of raw sugar, was equivalent to a total output in terms of white sugar of 887,525 tons. The production of dried pulp in all forms was 543,253 tons and molasses produced amounted to 321,507 tons.

The capacity of the factories, as the result of many years' carefully-planned capital expenditure, reached a record figure of 50,600 tons per day, which is nearly 1,600 tons per day higher than the figure of last year. Nevertheless, it was only on 1st March that the last factory concluded operations.

The degree of sugar extraction in terms of white sugar and molasses as a percentage of the sugar in the beet is of great importance. For the year 1960/61 the figure is 96·4%, which is slightly lower than last year's record when the sugar content of the beet was exceptionally high.

By new methods and as a result of the installation of new plant and machinery further advances have been made in efficiency. During the year the factory at Spalding was converted from raw to white sugar production. Other major items of capital expenditure were new erection plants at Allscott and Selby, new packeting plant at Brigg, improved beet reception at Poppleton, Bury St. Edmunds and Kidderminster, new pulp driers at Ely and Kidderminster, new power plant at Cantley and Ely, and new filtration plants at Ely, Felsted and Peterborough. Automatic control is incorporated in all new items and has been extended to many existing ones. These controls improve efficiency and give a higher quality product.

Liquid sugar plants have been installed at two factories and further silo capacity for 20,000 tons refined sugar is also being provided. It is intended to construct more silos for storing sugar in bulk in the future.

* * *

Cuban sugar production and sales[1].

Although no official production statistics have yet been released by Cuba, the General Manager of the Cuban Sugar Mills is reported to have stated in the course of a recent television appearance that the crop had closed with a final outturn of 6,550,000 Spanish tons, which represents an increase of some 860,000 tons on last season's figure and is the second highest outturn in the history of the Island. Some nervousness has been reported from New York that Cuba will be forced to adopt an aggressive selling policy in order to dispose of so large a tonnage but it is difficult to see what could be achieved by such tactics as there would appear to be few prospective outlets for substantial quantities of sugar still remaining to be filled

[1] C. Czarnikow Ltd., *Sugar Review*, 1961, (514), 117.

this year. In any case Cuba's exports are limited by the International Sugar Agreement to 1,992,000 metric tons under quota together with a tolerance under Article 8 of approximately three million tons. Indeed, far from pressing the market, it would appear that if Cuba should wish to sell any tonnage in excess of this quantity it would be necessary for her to adopt a strong selling policy in an endeavour to raise prices to the level where the Council would be obliged to increase quotas.

* * *

Booker Bros. McConnell & Co. Ltd., Annual Review, 1960.

The weather in 1960 was exceptionally favourable for sugar growing and harvesting in British Guiana, but only the hard work of everyone in field and factory enabled a record crop of over 270,000 tons to be produced on the estates for which Bookers are responsible—nearly 20,000 tons more than the former record crop of 1958.

Permanent export quotas would not have allowed export of the whole of this crop but some additional temporary quota allocations were fortunately received, including a new outlet for 24,000 tons in the favourably priced United States market. However the free world market price, at which over one-third of the sugar was sold last year, remained at a wholly unprofitable level and sugar profits were very little better than those earned in 1959.

Increased throughput for the factories meant some opening-up of the mills, even at the risk of lost efficiency. In the event, however, mill extraction suffered only slightly, while boiling-house efficiency actually improved. Eight out of the nine factories secured new production records—records entailing working longer hours and grinding for more weeks. Comfortable factory capacity can only be geared to increase in proportion to permanent export quotas; and thus a year like 1960 of virtually unlimited and fortuitous outlets necessarily puts considerable strain on factory staff and plant.

The core of future factory development plans will be the reconstruction in the next few years of the Wales and Albion factories—the latter to cope initially with up to 130 tons of cane per hour. These will be further steps in the continuing post-war programme of factory rehabilitation—Uitvlugt, Rose Hall and La Bonne Intention factories having so far been radically modernised or entirely rebuilt.

At the pilot project in Nigeria the experimental plots reaped so far have indicated that satisfactory yields of sugar can be expected. The final decision whether to go ahead with a full-scale project was to be taken in June with the Federal and Northern Regional Governments and the Northern Region Development Corporation. If the decision is favourable the next step will be to set up a Nigerian company in which Bookers will have a minority shareholding and will serve as managing agents. The Nigerian Governments have appreciated the necessity for protecting a local sugar industry and, in anticipation of the project going forward, have introduced an import duty on sugar.

In Jamaica during 1960 Bookers Agricultural Holdings acquired a 55% interest in Innswood Estate Limited. This is a medium-sized estate, having made an average crop of about 15,000 tons of sugar in recent years. The estate's crop in 1960 was an all-time record of 19,097 tons but, in terms of total Booker Group assets employed and profits earned, this venture is still of course small.

Bookers Sugar Machinery Group, George Fletcher & Co. in Derby and Duncan Stewart & Co. in Glasgow, achieved record new orders and output, of which the proportion represented by exports was more than half the total sugar machinery exported from the United Kingdom in 1960.

* * *

Philippines non-quota allocation[1].

The U.S.D.A. announced on 30th June that an additional 150,000 short tons, raw value, of sugar have been reallocated to the Philippines. With this reallocation the total quantity to be procured from the Philippines in 1961 under the basic quota and previous reallocations is 1,470,731 short tons, raw value, reducing the total quantity of unallocated sugar to 50,000 tons.

The statement of bases and considerations issued by the U.S. Dept. of Agriculture states that immediately prior to the 1st June reallocations, information was obtained through the United States Embassy in Manila as to the supply of sugar that could be made available by the Philippines during 1961. From the information received it was concluded that the Philippines could not supply for arrival in the continental United States during the calendar year 1961 any sugar in excess of the previously assigned basic quota and reallocations totalling 1,320,731 short tons, raw value. Actual receipts of sugar in the United States for the year to date and other information corroborated that conclusion. Accordingly, no provision was made for the purchase of additional quantities of non-quota purchase sugar.

Since 1st June, the Government of the Republic of the Philippines has contended (a) that it is legally entitled to its proration of the reallocation and (b) that it can supply for arrival in the United States by 31st December 1961 the additional sugar from stocks on hand and from the next crop by starting the harvest of its 1961/62 crop in September, a month earlier than normal. The Sugar Act requires the granting of such a reallocation only to the extent of the country's ability to supply the sugar.

The present action is based solely on the assurances given by the Philippine Government that it can and will fill the additional proration of 150,000 short tons, raw value, herein provided. Accordingly, the quantity of sugar which now may be imported from the Republic of the Philippines within the calendar year 1961 is 1,470,731 short tons, raw value.

[1] *Lamborn*, 1961, **39**, 125.

A RESEARCH BACKGROUND FOR RECOMMENDATIONS FOR SUGAR CANE FERTILIZATION

By L. D. BAVER
(Director, Experiment Station, H.S.P.A.)

PART II

Interrelationships between various Composition Factors

The data in Fig. 7 show that there is a fairly good correlation between 8–10 N and leaf N, even though considerable fluctuation of LN with age was illustrated in Fig. 2. The correlation between the two values is higher at six months of age than at 12. The shape of the curves points out that the leaf N shows greater differentials at lower nitrogen levels. Whereas LN varies between about 1% to a little over 2·5%, the 8–10 N ranges from less than 0·1% to nearly 0·7%. One is about a 150% increase; the other is about 600%.

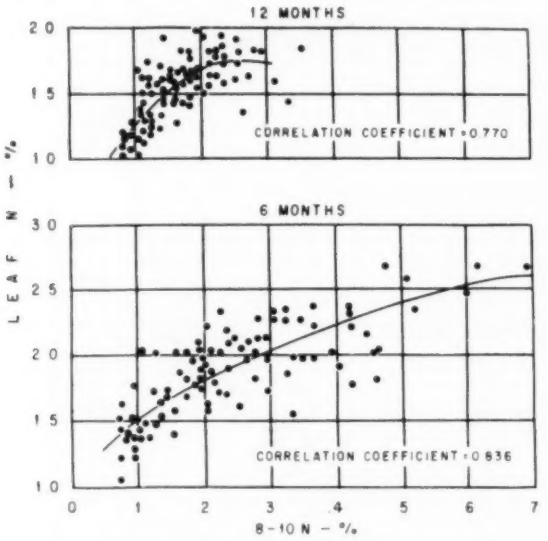

Fig. 7.—The relation between 8–10 N and leaf N

The relation of reducing sugars (RS) to plant N is given in Fig. 8. Nitrogen fertilization has a pronounced effect upon the formation of reducing sugars. This is a basic plant physiological relationship and should be expected.

The correlation between sheath K and 8–10 K (Fig. 9) is very high, with a coefficient of 0·917. This close relationship was previously indicated in Fig. 4. This is the highest correlation between any of the leaf or leaf sheath values with corresponding stalk tissue compositions. It is probably significant that both values were originally based upon replicated field experiments. Not only are sheath K and 8–10 K highly correlated between themselves, but both exhibit a very high degree of correlation with available soil potassium. This is shown clearly in Fig. 10. These high correlation coefficients make the available soil

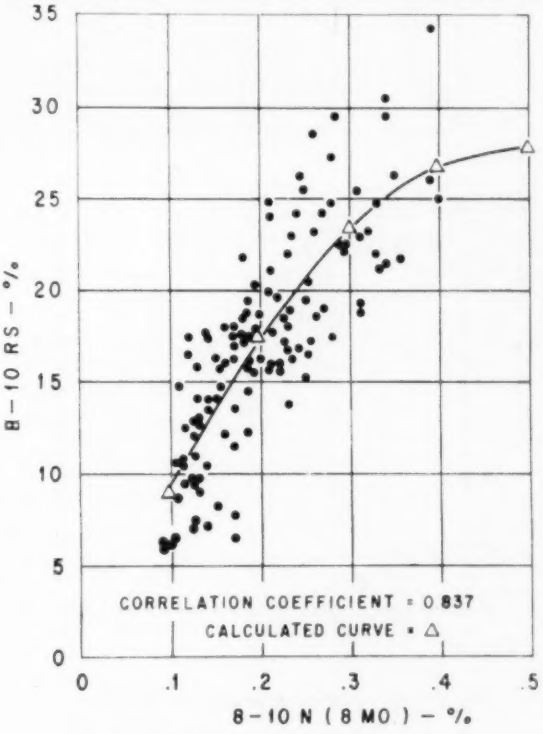

Fig. 8.—The relation of 8–10 RS to 8-10 N

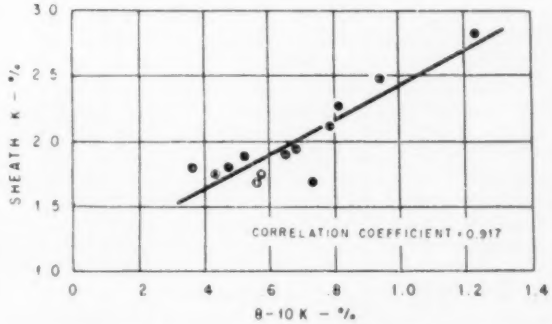

Fig. 9.—The relation between 8–10 K and sheath K

K an important part of soil-plant analyses for establishing fertilizer recommendations.

Phosphorus correlations are not quite as good as the ones just discussed with potassium. The results in Fig. 11 indicate a fairly close relationship between basal P and 8–10 P. The correlation coefficient is

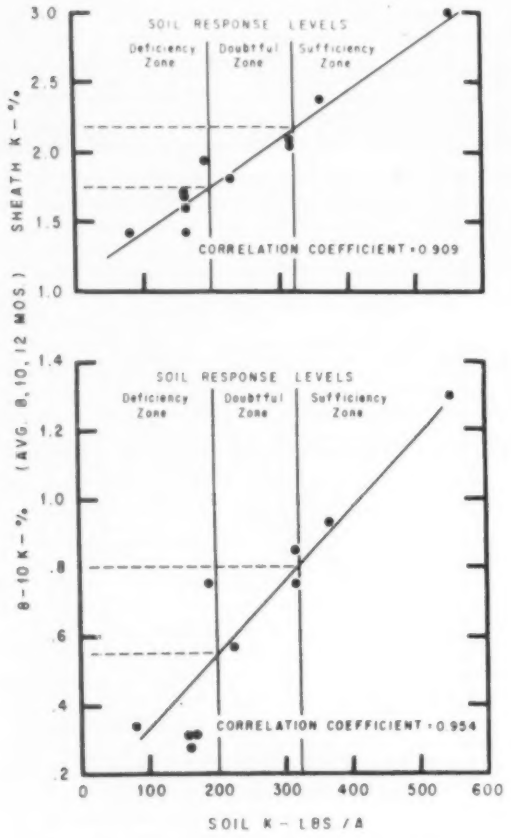
SOIL RESPONSE LEVELS
Deficiency Zone
Doubtful Zone
Sufficiency Zone
SHEATH K – % (AVG 8, 10, 12 MOS.)
CORRELATION COEFFICIENT = 0.909
8–10 K – %
CORRELATION COEFFICIENT = 0.954
SOIL K – LBS / A

Fig. 10.—The relation of plant K to soil K

0·704. The 8–10P is only slightly higher than basal P, indicating less translocation within the plant than for nitrogen and potassium. The correlation between 8–10 P and sheath P is exceedingly poor with a coefficient of only 0·171. When 8–10 P and sheath P are correlated with the available soil P from these seven locations, the correlation coefficient for the 8–10 P is 0·440; that of the sheath P is 0·072. Two of the 11 points on the 8–10 P-soil P curve were responsible for decreasing the magnitude of the correlation. When these data are superimposed upon a previous curve determined from other phosphate experiments, the points fall closely to the curve, with the exception of the two referred to previously (Fig. 12). The overall correlation between 8–10 P and soil P is very good. The lack of correlation between sheath P and either the composition of the stalk or the soil confirms numerous observations that the sheath P is not a satisfactory index of the phosphorus needs of the plant. (It should be mentioned parenthetically that there has been some revision of the phosphorus index in the crop logging procedures since this experiment.)

There is a fairly good correlation between sheath moisture and 8–10 moisture. This was indicated previously in Fig. 5. The correlation coefficient between these two values at six months of age is 0·753. It decreases to 0·570 at 12 months. At six months, the average 8–10 M values range between 82·5 and 87%; the sheath M varies only between about 81 and 83%. The moisture content of the 8–10

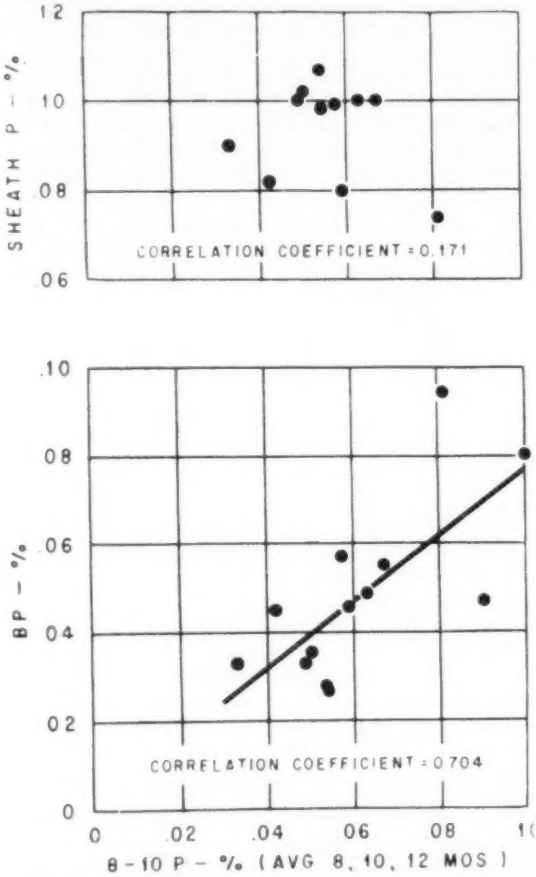

Fig. 11.—The relation between 8–10 P and basal P and sheath P

tissues is generally higher than that of the leaf sheath at all stages of growth.

It was suggested from the curves of Figs. 2 and 5 that there was a correlation between plant N and plant moisture. This is not a new proposition since such a relationship had been indicated by previous analyses of crop logging curves. The correlation

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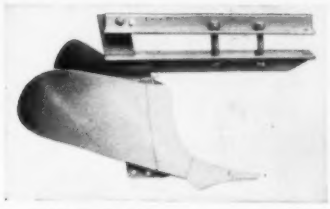

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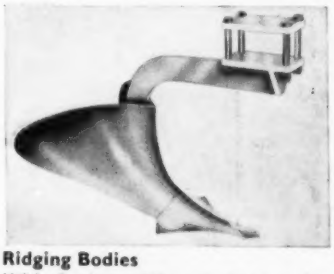

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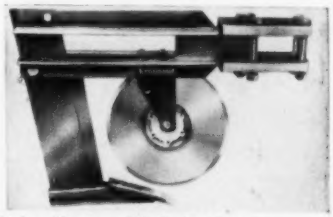

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coefficient in this study for the relationship of 8–10 N to 8–10 M was 0·808; that for the leaf N-sheath M relation was 0·634. These results confirm all previous data and observations.

The highest correlation between plant moisture and any other composition factor was obtained by correlating reducing sugars with moisture. The curves in Figs. 13 and 14 illustrate this fact quite clearly and justify the following conclusions:

1. The correlation between 8–10 RS and 8–10 M is much higher than that between 8–10 N and 8–10 M. The curve in Fig. 13 represents points from all treatments and ages at seven plantations. When one compares the correlation coefficient of 0·852 for 8–10 RS *vs.* 8–10 M with the coefficient of 0·604 for 8–10 N *vs.* 8–10 M for the same plots, the significance of the reducing sugar effect becomes obvious.

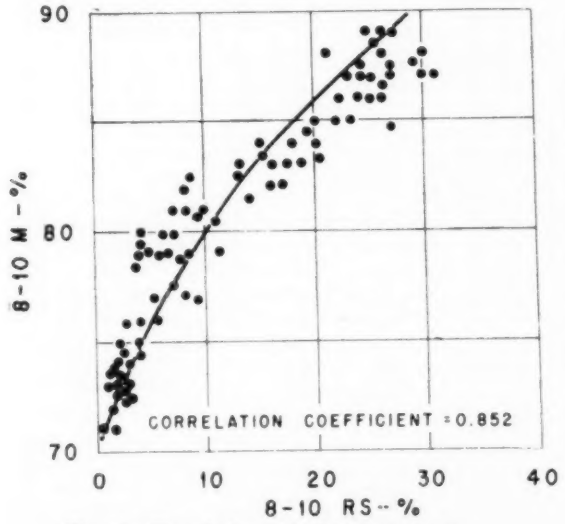

Fig. 13.—The relation of 8–10 M to 8–10 RS

2. The correlation coefficient of 0·939 between 8–10 M and the 8–10 sucrose-reducing sugars ratio, shown in Fig. 14, is the highest obtained between any other plant composition factor and plant moisture. These data include samples from 6 to 24 months of age. They point out that under the conditions of early fertilization, an 8–10 M of from 74 to 75% at harvest assures a good sucrose-reducing sugars ratio.

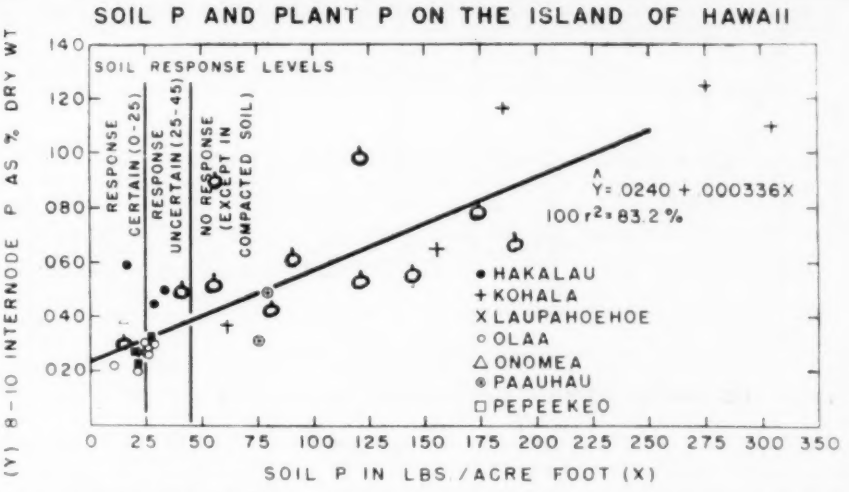
SOIL P AND PLANT P ON THE ISLAND OF HAWAII
SOIL RESPONSE LEVELS
RESPONSE CERTAIN (0-25)
RESPONSE UNCERTAIN (25-45)
NO RESPONSE (EXCEPT IN COMPACTED SOIL)
Ŷ = 0240 + 000336X
100 r² = 83.2 %
• HAKALAU
+ KOHALA
X LAUPAHOEHOE
○ OLAA
△ ONOMEA
⊛ PAAUHAU
□ PEPEEKEO
(Y) 8-10 INTERNODE P AS % DRY WT
SOIL P IN LBS / ACRE FOOT (X)

Fig. 12.—The relation of 8–10 P to available soil P (after HARTT: *Hawaiian Planters' Record*, 1958, **55**, 267). ◊ represents the P values obtained in this study.

3. In analysing the data in Figs. 8, 13 and 14, one is led to suggest the possibility that the relationship between 8–10 N and 8–10 M is indirect through the impact of nitrogen on the production of reducing sugars.

Plant Composition in relation to Fertilizers

The bar graphs in Fig. 15 show the percentage increase over the check (N_1K_3 or N_3K_1=100%) in the nitrogen and potassium contents of stalk and leaf sheath tissues at six months of age. The N responses were plotted from the 400-lb K_2O treatment; the K responses from the 300-lb N treatment. The following facts are obvious from these data:

1. Nitrogen fertilization had a very small effect upon the percentage increase in leaf N. At Kekaha, Olaa and Olokele (Fig. 15), there was only a very slight increase in leaf N over the check with as much as 300 lb N. At Lihue, Grove Farm, Oahu and Pioneer, 300 lb N did not increase the nitrogen content over the 150 lb application. The leaf-N reaction to nitrogen fertilization was most pronounced at Oahu where nitrogen levels in the check were very low.

2. Basal N and 8–10 N show a much sharper response to nitrogen fertilization than leaf N.

3. Basal N is more sensitive to nitrogen fertilization than the 8–10 N.

4. The order of sensitivity to nitrogen fertilization was as follows for the 26 cases involved:

(*a*) BTN > 8–10 N or LN	85% of the cases
(*b*) 8–10 N > BTN or LN	15% of the cases
(*c*) 8–10 N > LN	92% of the cases
(*d*) LN > 8–10 N	8% of the cases

5. Potash fertilization generally had a rather pronounced effect upon the K composition of the stalk and leaf-sheath tissues. The major exception

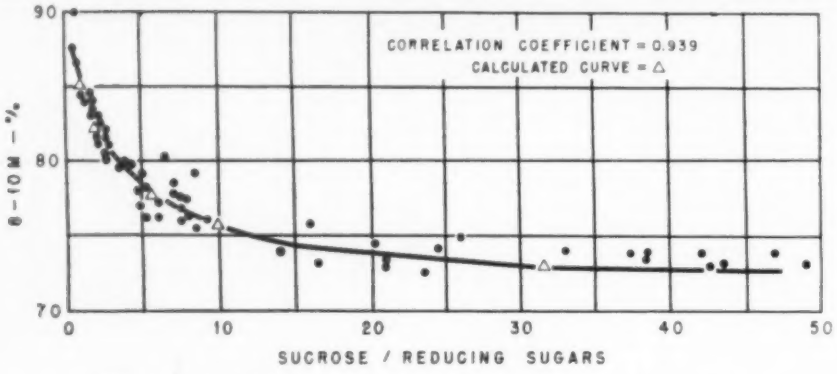

Fig. 14.—The relation of 8–10M to the sucrose-reducing sugar ratio

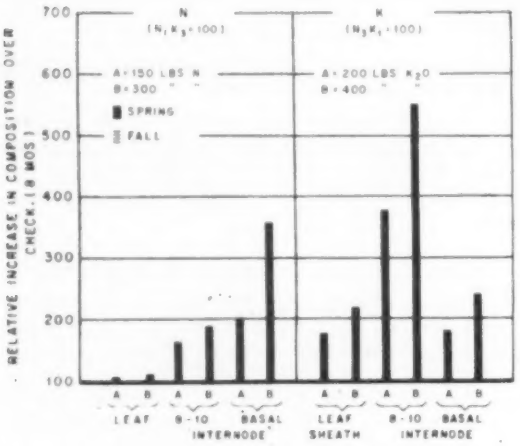

Fig. 15.—The relative response of cane tissues to N and K_2O fertilization. Olokele Sugar Co.

was Oahu where the available soil potash was high. Even here, the various tissues demonstrated a slight increase in K content.

6. The 8–10 K was more sensitive than either the sheath K or basal K. The order of sensitivity for the 26 cases was:

(*a*) 8–10 K > SK or BK	73% of the cases
(*b*) BK > 8–10 or SK	27% of the cases
(*c*) 8–10 K > SK	100% of the cases
(*d*) SK > BK	46% of the cases

Nitrogen fertilization has a repressing effect upon the potassium and phosphorus composition of the plant. These effects on potassium (Fig. 16) and the phosphorus curves are very similar. The following points are worthy of note and discussion:

1. The amount of K and P repression is related to the quantity of nitrogen applied; that is, $N_3 > N_2 > N_1$.

2. About 400 lb K_2O were required to counterbalance the repressive effect of 150 lb N. This was on a soil where there is no response to potash fertilization.

3. The largest repressive effects are during the first year's growth.

4. The K or P content of plants growing on soils that have higher amounts of available potash or phosphorus decreases more rapidly with nitrogen fertilization than in the case of plants growing at lower nutrient levels.

5. There is no clear-cut evidence from these experiments to prove that this decrease in K or P composition results in a decrease in the yield of sugar.

6. It has been demonstrated with a wide variety of crops that the major impact of nitrogen fertilization is to cause rapid growth of the plant. It has been

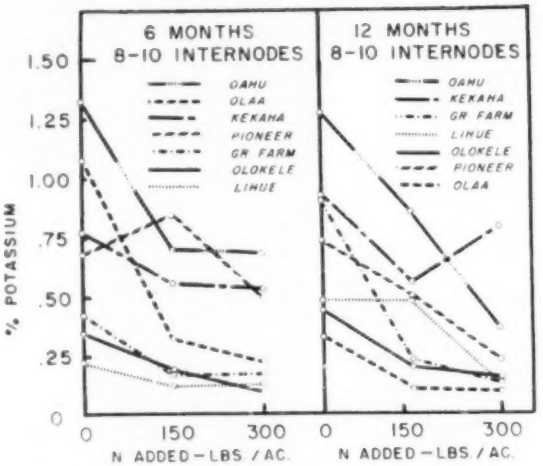

Fig. 16.—The effect of N fertilization upon 8–10K levels

observed that the ratio of top growth to root development increases substantially. These effects would be expected to lead to

(*a*) a decrease in K or P composition just as a matter of dilution;

(*b*) a decrease in K or P composition due to the inability of the absorbing root surfaces at the soil-root interface to keep pace with the demands of the above-ground portion of the plant. Root-soil contact is very important in the absorption by the root of the nutrients adsorbed on the soil colloidal fraction.

(To be continued)

THE SUGAR CANE IN AUSTRALIA

60th Annual Report, Bureau of Sugar Experiment Stations, 1959-60

THE problem of over-production, mentioned in the last report[1], still persists, and that persistence arises from various factors among which are the greater yielding potential of the newer varieties, better control of pests and diseases and more efficient mechanical equipment. Former marginal land has thereby become economically productive. Additional causes in the year under report lie in the unusually good quality of standover cane and the high c.c.s. value generally, 1 ton of sugar being obtained from under 7 tons of cane. The dangers inherent in too great a dependence on monoculture are apparent and alternative crops such as cowpea and cotton are being tested together with cattle feeding, using the excess cane as fodder. Illustrated are two outfits employed in the destruction of standover cane; in one, a tractor is fitted with a blade in front and a rear roller, the residues, after burning, being ploughed in. The second is a forage harvester.

Soils and Agronomy

Forty-seven trials with ammonium sulphate, following the turning-in of a green manure crop 3 months before planting, showed a response in a few cases only with a depressive effect on the c.c.s. in the early half of the season.

In all the 9 potash experiments, the control gave the lowest yield with a significant response in 6. Leaf analyses offer hope of determining a critical K content in the leaf, below which a response will always be obtained. Soil and sub-soil determinations indicated a gradual increase in the available K in the soil. Where Cu deficiency occurs, 14 lb/acre copper sulphate appears to be an adequate dressing, eliminating the symptom of Cu deficiency known as "droopy top." Salinity problems have assumed growing importance with the extension of the area under cane to marginal lands and comparative specific electrical conductivity tests were made with a 1:5 soil–water suspension to provide an approximate critical level.

The trend of the nematode investigations suggests that "Nemagon" broadcast at 2 to 2·5 g per acre is superior to other treatments and has a residual effect in the suceeding ratoons. In one case DD caused an initial reduction of the nematode population followed in 6 months by an increase to double the original population.

Station Reports

The several Experiment Stations form the seats at which plant breeding and pathological and entomological investigations are carried out, and the results are summarized in the respective sections of the Report. At the Central Station the 8th crop of the trial in trash conservation has been harvested with no resultant significant increase in crop. The 5th crop covering the application of bagasse yielded the following (total tons/acre): bagasse plus deep ripping 123·1, ripping only 120·14, control 110·97.

Plant Breeding

A modified solution, composed of 100 p.p.m. sulphur dioxide, 50 p.p.m. phosphoric acid and 25 p.p.m. each sulphuric and nitric acids, was adopted throughout. The lighting system for period control of flowering was also extended and CMU added to maleic hydrazide as a means of delaying flowering. Trials with bunch planting also continue. Revision of the methods of selection suggest that over 50% of the varieties selected for propagation on farms would have been rejected under the older system. A higher proportion of selections, with plots reduced from 0·05 to 0·01 acres, is considered desirable.

With Queensland cane now occupying 82·6% of the area under cane, Pindar, Q.50 and Trojan retain the lead. Q.58, Q.57 and N: Co 310 are expanding rapidly as also are Q.70, Q.68 and Q.66.

Entomology and Pathology

Over-production had induced a certain slackness in the application of control measures; undesirable, because the increased area of standover cane fosters both pests and diseases. This effect was to be seen in particular in the case of the various species of cane grubs. For their control "Lindane" or BHC provide adequate control. Trials indicate that other leading pests, funnel ants (*Aphaenogaster pythia*), soldier fly *Metoponia rubriceps*) and earth pearls (*Margarodidae*) have a differential response to the various insecticides.

The problem of chlorotic streak and its causal agent still defies solution and attempts at transmission have been inconclusive; in particular, no association between it and nematode infestation was found. Notes on other diseases indicate generally effective control; in particular, not one stool infected with with Fiji disease has been found.

H. M.-L.

Performance of twenty hybrid seedling clones. V. C. CALMA *et al. Sugar News* (Philippines), 1960, **36**, 583–589.—Plant and ratoon crops of seedlings belonging to the 56 series and raised at the College of Agriculture, Laguna, are recorded; 14 are recommended for further trial.

[1] *I.S.J.*, 1960, **62**, 251.

AGRICULTURAL ABSTRACTS

Some effects of topping sugar cane seedlings. M. T. ILAGA *et al. Sugar News* (Philippines), 1960, **36**, 639–643.—Topping seedlings 1 week before transplanting stimulated early growth, but gave a reduced number of tillers as compared with topping at transplanting and no topping. No topping yielded the maximum number of tillers.

* * *

Coloured bagasse—an ideal product for mulching. W. L. OWEN. *Sugar y Azúcar*, 1960, **55**, (11), 45.—A market exists for bagasse, particulary in fruit orchards, but labour costs and time required for its stabilization is long and there is considerable loss of weight. A system of treatment with non-toxic mordant and dye, both unspecified, has been worked out, yielding an acceptable product at economic cost.

* * *

Some factors adversely affecting cane production. W. E. CROSS. *Sugar J.* (La.), 1960, **23**, (6), 26–28.—With the extension of the area under cane in the Argentine, marginal land has been brought under cultivation. The various problems thereby raised are discussed.

* * *

Cultivation of sugar beet by transplanting. G. OBOLENSKY and S. TARTCHINSKI. *Qualitas Plantarum et Materiae Vegetabiles*, 1960, **7**, 359–370.—A new method of sugar beet production in Yugoslavia is described. It consists of transplanting young seedlings in irrigated or non-irrigated fields at distances of 45 cm between rows and 16 cm in the row, the best results being obtained with seedlings whose taproot is not thicker than straw. Early planting is possible using seedlings raised in hot-beds from seed sown in February. Harvesting and milling may then commence in August. The crop may be alternated with wheat. Good yields and great economy in seed are claimed.

* * *

Gumming disease of sugarcane. A. C. HAYWARD. *Commonwealth Phytopathological News*, 1961, **7**, 1–2.—In connexion with studies on suspected strain variation in gumming disease (*Xanthomonas vasculorum*) visits were made to Mauritius and other cane growing countries of the Indian Ocean region. An initial examination of the isolates from various sources showed that there was a constant cultural difference between the isolates from Madagascar and Natal on the one hand and those from Mauritius and Réunion on the other. Other bacterial diseases of cane in the Indian Ocean region which might be confused with *Xanthomonas vasculorum* are referred to, only leaf scald being regarded as economically important. In connexion with his work the writer is anxious to obtain freshly collected specimens of suspected bacterial diseases of sugar cane from other parts of the world.

Factors influencing storage decay of sugar beets by Phoma betae and other fungi. M. W. CORMACK and J. E. MOFFATT. *Phytopathology*, 1961, **51**, 3–5.—In southern Alberta, Canada, it was found that the fungus *Phoma betae* was responsible for most of the decay to be found in stored sugar beets. Allowing the roots to wilt before storage was conducive to decay. Temperature was also all-important. Normally autumn and winter temperatures in Alberta are sufficiently low to inhibit decay.

* * *

"Fenac"—a new pre-emergence weed killer. L. L. LAUDEN. *Sugar Bull.*, 1961, **39**, 93.—"Fenac" (2,3,6-trichlorophenylacetic acid) at 2–3 lb per acre, used only in the drill as a pre-emergence weed killer, has given good control of Johnson grass but, from the many emphatic precautionary instructions given for its use—e.g., "under no circumstances should it be used on cane to be milled this year"—it is obviously highly potent and dangerous.

* * *

Recommendations for controlling sugar cane insect pests in Louisiana, 1961. ANON. *Sugar Bull.*, 1961, **39**, 136.—A brief account is given of borer control by insecticides, cultural practices and the growth of resistant varieties such as N:Co 310, classed as moderately resistant.

* * *

Sugar cane borer populations in "Endrin"-treated fields. S. D. HENSLEY *et al. Sugar Bull.*, 1961, **39**, 150.—The comparisons are on the basis of dead hearts. In 31 comparisons the reduction was 44%.

* * *

The practical control of mosaic disease in Louisiana. M. L. SHAFFER. *Sugar Bull.*, 1961, **39**, 162.—The growing incidence of mosaic has led to the formation in 1959 of a Committee of the American Sugar Cane League to organize the supply of disease-free cane. Its activities are here described.

* * *

New method for rating sugar cane varieties for susceptibility to the sugar cane borer in Louisiana. W. H. LONG *et al. Sugar Bull.*, 1961, **39**, 175.—The basis of varietal comparison here is the % joints bored on two fields of each variety, one treated with "Endrin" and the other untreated.

* * *

The sugar cane borer in the Cuban economy. C. B. CUETO R. *Bol. Ofic. A.T.A.C.*, 1960, **19**, 369–374.—A brief account covering the establishment of, and the losses caused by, the borer, *Diatraea saccharalis*, is followed by a discussion of the conditions under which *Lixophaga diatraeae* establishes itself. An official commission for the whole island is proposed to evolve a general scheme for biological control.

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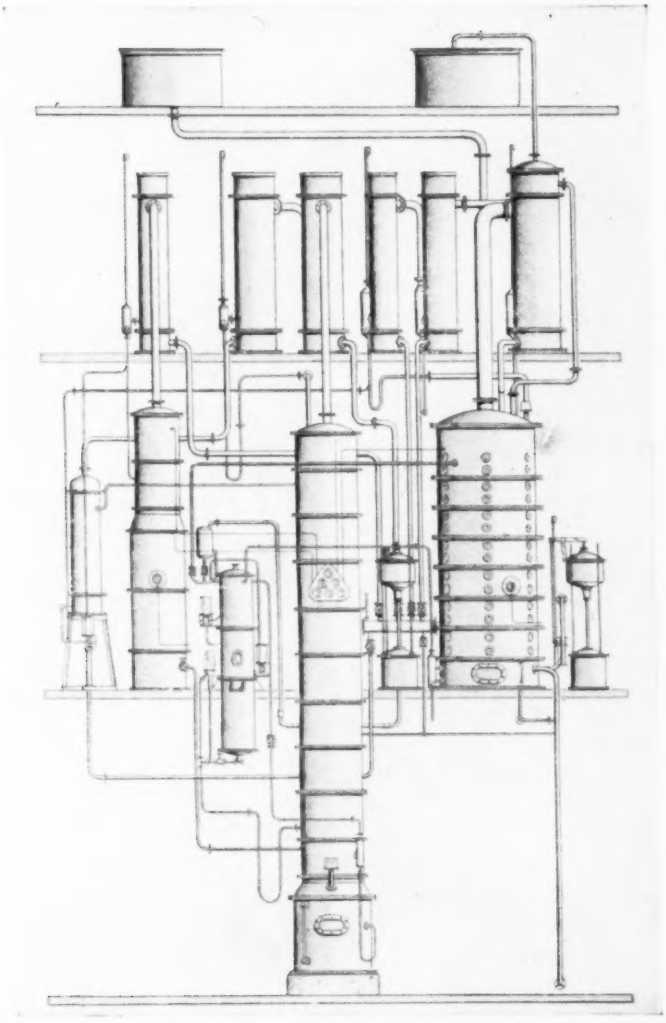

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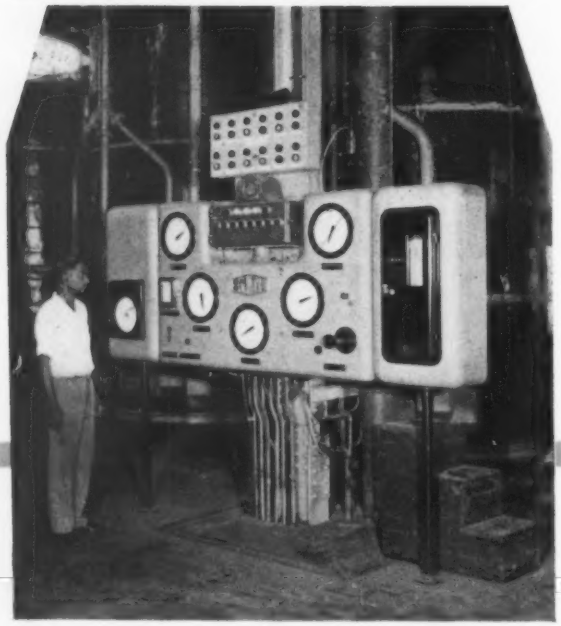

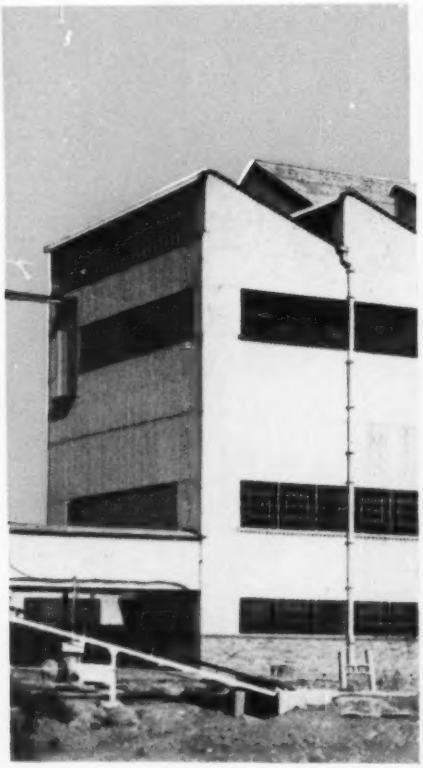

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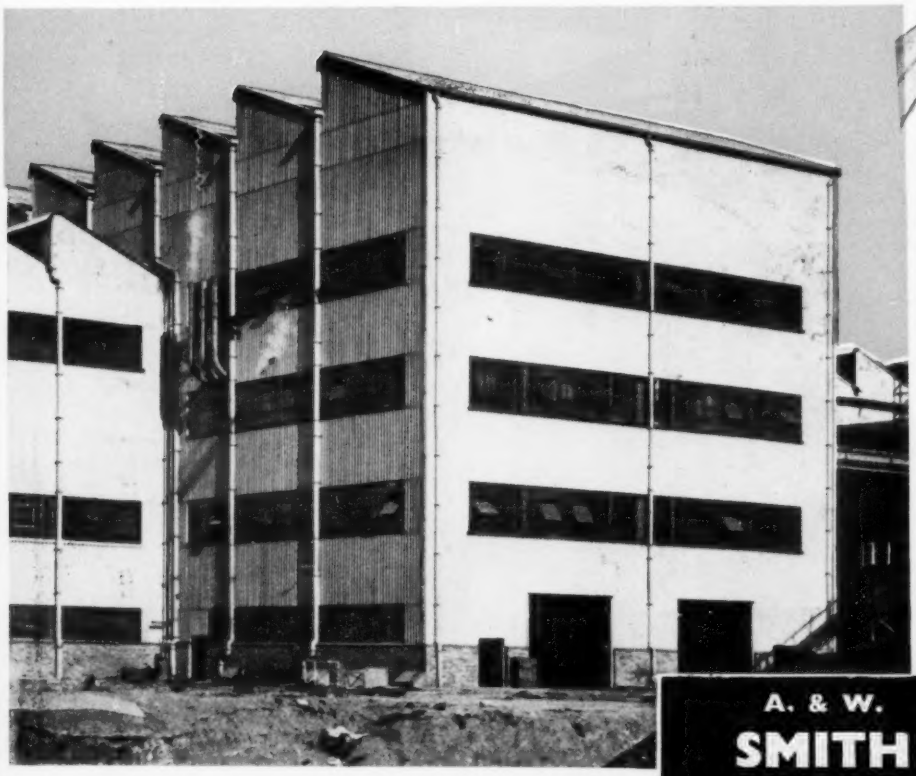

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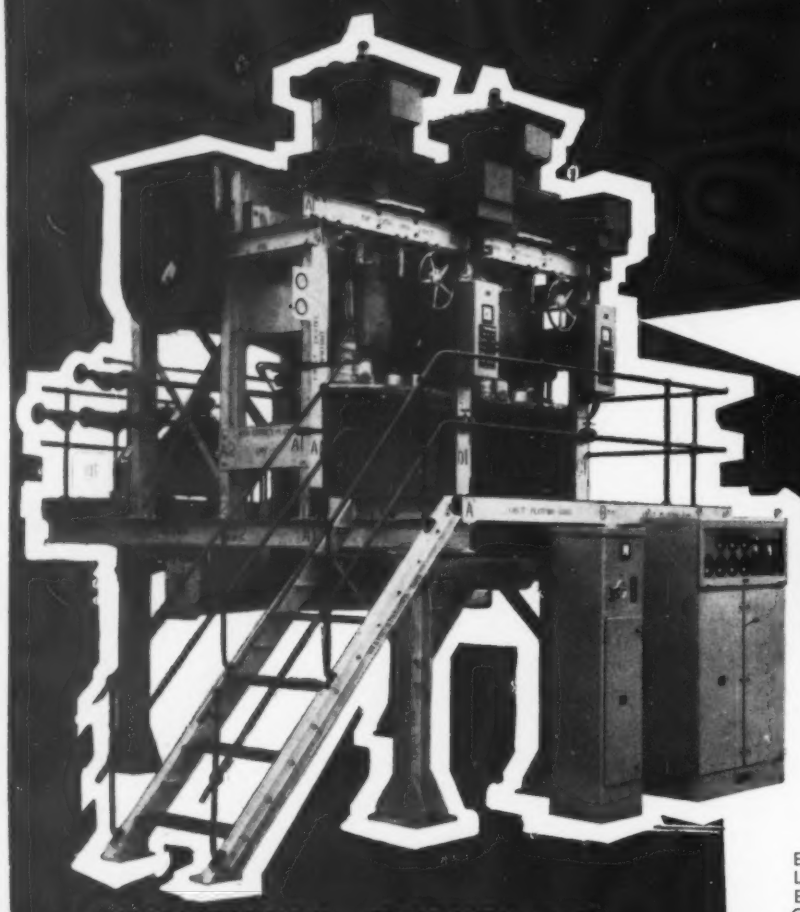

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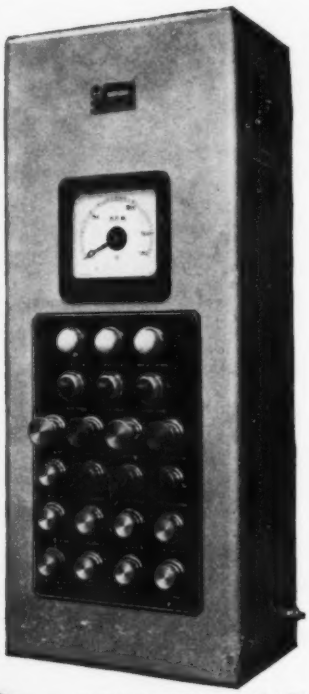

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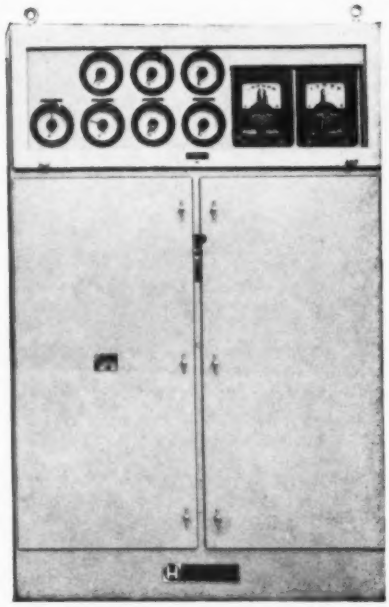

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By F. SCHNEIDER, E. REINEFELD and H. P. HOFFMANN-WALBECK
(Sugar Institute, Technische Hochschule, Braunschweig)

PART I

WE have made a study of the De Smet diffuser at the Vic-sur-Aisne sugar factory (France) with particular reference to the following factors:

diffusion efficiency and throughput,
retention time,
extraction,
cossette quality, and
the microbiological conditions in the plant.

The results are reported below. First, we would like to give some data on the process.

The Process and Juice Extraction Plant

(*a*) *Process* (see Fig. 1)

The factory processed about 1500 tons of beet daily during the time of the investigation. Juice was extracted only in the De Smet diffuser, the nominal capacity of which was 1500 tons per day. Thus the plant was fully loaded.

Cossettes sliced with 22-division Königsfeld knives were processed. Three Maguin slicers (horizontal disc knives) were available; of these two could be regulated (2·2 and 2 m disc dia.). Blank frames were installed in the other machine (disc dia. 2·0 m). Either the larger machine operated alone or the two smaller ones together.

Flow of the fresh cossettes was as follows:

Slicers → chute → belt conveyor → belt weigher (Fourray, Paris; 10 weighments per min, maximum 120 tons/hr) → heat exchanger (separator) → diffuser. From the separator, the cossettes were fed into a flume pipe (of about 1:25 gradient) in which they were flushed into the diffuser with "scalding juice" (400% on beet) (Fig. 1).

The separator (Fig. 2), a sloping scraper belt with 3 screens, had a 20° slope and was 8·5 m long. The raw juice withdrawn was fed under gravity and run three times over the fresh cossettes in counter-current, being thus cooled from about 78–80°C to about 45°C. The exhausted cossettes from the diffuser went to the press station: diffuser → screw → elevator → screw conveyors → pulp presses (2 horizontal Maguin presses) → rake conveyor → yard (for loading). The pressed pulp was delivered as "wet pulp" with about 10% dry solids content.

The press-water was returned to the diffuser, the flow scheme being unfavourably long: presses → tank → about 35 m of piping → pulp catchers (vibratory with flume-water dilution*) → concrete basin (partial sand removal and chlorination) → pump → 1st heater (heat transfer from condensate, the cooled condensate then going to the drain) → 2nd heater (2nd vapours) → press-water tank(above diffuser and in form of settler with automatic discharge) → diffuser. Danger of infection in the press-water circulation was increased by pumping the press-water containing pulp from the vibrating pulp catcher over the exhausted cossettes before the presses.

The amount of chlorine added to the press-water according to factory data was very high at about 1·8 kg/hr; doses were added during 1 min with a 2-minute interval between each.

The withdrawn raw juice (→ separator) and the scalding (circulation) juice were taken from a raw

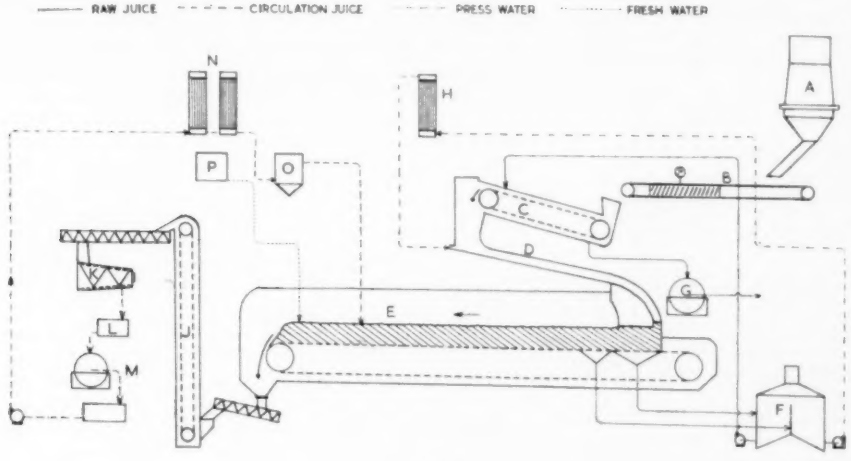

Fig. 1

A—slicers
B—belt weigher
C—separator
D—flume pipe
E—diffuser
F—raw juice tank
G—raw juice pulp trap
H—heater (circulation juice)
J—pulp elevator
K—pulp press
L—press-water tank
M—pulp trap and concrete tank
N—press-water heater
O—press-water tank
P—fresh water tank

*This dilution has basically a negative effect on extraction; it would be better to increase the fresh-water proportion accordingly.

juice tank with a partition and a conical base (see Fig. 1). The circulation juice was fed into the flume pipe after passing through a heater (78/80°C — 88/90°C), the raw juice being cooled, depulped and fed to juice purification.

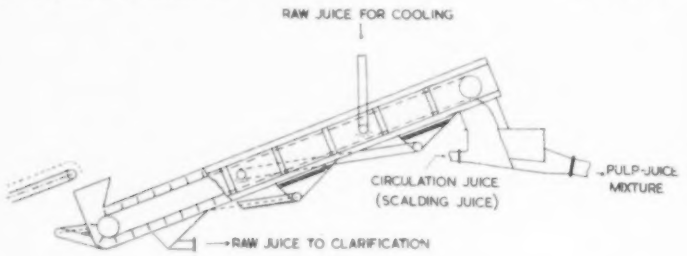

Fig. 2

The pulp from the raw juice was pumped to the diffuser with some raw juice ("flume juice") shortly after the cossettes were fed (see below). The press-water fed to the diffuser has a temperature of about 68°C ("local partial return," see Fig. 1). River water, treated with a small amount of SO_2 was used as fresh water (pH 6·2, temperature about 8°C).

Beet particles and tails were not processed, but remained with the leaves in the yard. It should be mentioned that the beet were very dirty and were delivered with a particularly high content of stones, weeds and leaves, resulting in frequent stoppages in the beet flow to the slicers.

(*b*) *Diffusion plant*

The De Smet is a continuous diffuser with extensive cossette and juice forced feeding; it is in the form of a so-called spray diffuser. The unit consists essentially of a horizontal endless cossette conveyor, which carries a compact layer of cossettes. This is so sprayed with circulated diffusion juice that counter-current extraction results (Fig. 3).

The unit is located in a housing which in the unit tested is 38·7 m long and 6·5 m wide (head 6·7 m). The highest point of the diffuser itself is about 7·9 m†, with the separator included about 11·5 m. The cossette conveyor consists of 2 endless chains with rollers (total length about 78 m, rollers at 900 mm intervals), which carry rigid right-angled elements of angle iron (5500 × 900 mm). A wire screen of Siemens Martin steel is mounted on these elements (wire dia. 2·5 mm, perforations 8 × 8 mm) and above this again a grid (crosspieces 20 mm apart). The total length of the cossette layer is about 33·3 m.

The rollers, which run on horizontal rails, are automatically lubricated on each circuit. The conveyor turns by means of wheels, which engage the chains every 8 rollers of the endless chains. On both sides of the diffuser every pair of wheels rotates on a fixed axle. At the "water" end, these guide wheels are connected to sprockets, which are also connected by means of extensions on each side to cams which are driven by a 16 h.p. motor through a variable control and intermediate gearing. The cossettes are thus transported intermittently, the conveyor moving 75 mm at a time. During the test period movement was at 14 second intervals (about 0·32 m/min), corresponding to a retention time of about 103 minutes. The drive permits variation within the range 60–200 minutes. The current (max. 25 A at 220 V) was 20 A during the test period when the conveyor was in motion, or otherwise 14 A. The return part of the conveyor with the rollers is easily visible and accessible beneath the diffuser.

The cossette layer on the diffuser is sprayed with diffusion juice in a series of 18 streams. The juice runs from gutters on to the cossettes, passing through

†According to the manufacturers, the height can be reduced by about 2 m by alterations to the substructure.

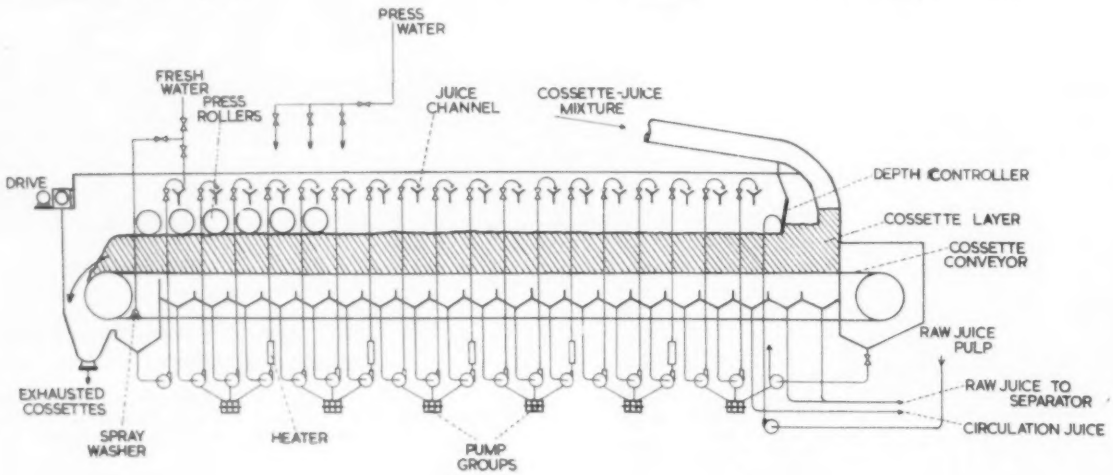

Fig. 3

the layer to 1·5 m wide sloping surfaces beneath the conveyor. Movable deflection plates allow the "distribution sections" to be altered. Part of each sloping surface runs sideways into a funnel (see Fig. 4) from which the juice is pumped into the next gutter. The pumps are grouped in threes, so that 3 rollers are located on one axle. Below the diffuser there are 6 triple-pump sets for the 18 streams. The drainage funnels have overflows, which allow the juice to flow directly from funnel to funnel below the cossette conveyor when the juice level is high; the diffuser has a slope of about 1:50.

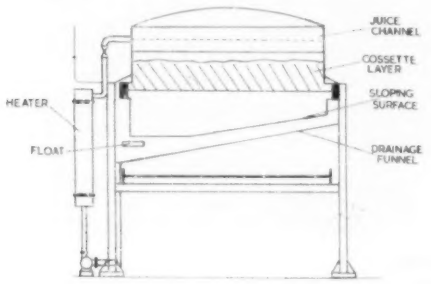

Fig. 4

A minimum amount of juice is retained in the drainage funnels by means of a float device (see Fig. 4)‡; thus the pumps do not draw in air and formation of foam is prevented. Pressure valves regulate the amount of diffusion juice in the individual stages according to the permeability of the cossette layer. This is very important as in this way the cossettes are brought into contact with the maximum possible amount of juice; according to the manufacturers, in most cases this is not the same as the raw juice draw-off or amount of water added. Thus, as a rule, after entering the diffuser, the cossettes will not be sprayed with the total amount of raw juice corresponding to the juice draw-off. The permeability of the cossette layer increases, however, towards the middle of the diffuser, and the spraying can intensify within certain limits even independently of the amount of juice withdrawn.

To prevent air currents above the cossette layer, the diffuser housing has baffle plates at the feed channels of sprays 7 and 14. Good temperature control is made possible by heating five of the juice streams with 2nd vapours using a heating surface of 8 sq.m., increasing to 10 or 14 sq.m. towards the water end. An Arca regulator is used. The discharge end of the cossette flume-pipe into the diffuser is so wide that the cossette surface below is sufficient for the passage of large amounts of circulation juice (400% on beet). Below the flume-pipe at the top of the diffuser is a funnel surface of double width for reception of circulation juice, which is fed to the tank for circulation juice and raw juice together with raw juice from the connected funnel. In the top of the diffuser there is also a device for indication of the cossette height above the conveyor. At the end of the feeding zone opposite the diffuser proper is a depth controller which regulates the thickness of the cossette blanket within mechanical limits of 500-1000 mm over the whole width of the conveyor and slightly compresses the compact layer.

The point at which the raw juice pulp is fed to the conveyor is directly behind the cossette depth controller. The exhausted cossettes fall at the bend in the conveyor at the water end into a funnel, from which they are taken by screw conveyor to the presses. Before the cossette discharge point, the cossette blanket passes under two rollers, placed one behind the other, so that the exhausted cossettes are well drained on leaving the diffuser (about 8% dry solids). Between the last five juice gutters are further pressing rollers, which exert a somewhat lighter pressure on the cossette later to allow the separation of juice and cossettes in the last diffusion stage to be as complete as possible and to promote de-sugaring of the cossettes.

Fresh water (cold) is added to the first channel at the water end. Some of this water is diverted§ for washing of the return section of the cossette conveyor, the whole width of which is almost completely cleared of adhering exhaused cossettes. This pulp, together with the wash water, is returned by pumping to the fresh water feed channel on to the cossette blanket. Above channels 3, 4 and 5 are three connexions for warm water (press-water) feed, which may be used at will.

Flow indicators are provided for the fresh and press water. There is no special control for juice withdrawal, the amount of juice drawn-off being deduced from the corresponding added amount of water with uniform operation. Only in the raw juice tank will an abnormal rise in the juice level be indicated. Apart from pumps for the water, there are the following pumps for the whole diffuser:

6 triple pump sets (each of 8 h.p.) for juice circulation in the diffuser;

1 circulation juice pump (45 h.p.) for "scalding";

1 raw juice pump (10 h.p.) for withdrawal (to the separator);

1 pump (4 h.p.) for the raw juice pulp;

1 pump (4 h.p.) for washing of the cossette conveyor at the water end.

One side of the diffuser is provided with a row of four funnels, through which defoaming agents are added. The consumption during the test period was relatively low—200 kg/week, or approximately 1·96 kg/100 tons of beet. The defoaming agent (fermentation fat) was added to the raw juice. Several rows of sight glasses (above and below the cossette conveyor,

‡When the pumps are idle, only a small amount of juice remains in the funnels. The major portion flows to the raw juice tank. The juice is removed from the funnels during "sweetening-off."

§During the test period the quantity of wash water was about 15 cu.m./hr, at a total fresh water feed of about 40 cu.m./hr.

about 30 windows) gave a clear view into the diffuser, the interior of which may be illuminated by lamps at about 26 further windows.

The diffuser was supervised by one man. At the control point is the usual diagram with control lights for all the conveyors and pumps as well as the following indicators:

Temperature: circulation juice after the heater; press-water; heaters 1-5. All controlled by Arca regulators.

Recorders: temperature of the fresh cossette-juice mixture; incoming press-water quantity (also, elsewhere, the raw juice temperature after the separator).

Current consumption: circulation juice pump; cossette conveyor; separator.

Special indicators: cossette blanket depth on the conveyor; raw juice level in the withdrawal tank, when this is abnormally high; compressed air supply to the regulators.

As a uniform cossette blanket must go to the conveyor, the indicated height of the fresh cossettes (feed chute) should not fall below the height of the depth controller. Operation of the diffuser is now automatic in that when the quantity of cossettes is too low, the cossette conveyor, heaters and water feed may be switched off. The same occurs when there is inadequate water supply. Otherwise, the unit is interlocked in the usual manner, i.e. if the separator stops, the equipment before it up to and including the slicers is automatically stopped.

(*To be continued*)

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SCIENCE *versus* WASPS

By FRANK JEFKINS

(Pest Advisory Centre, 16 Dover St., London W.1)

A SUGAR processing and packaging plant, situated in the middle of a beet-growing district, represents a bulls-eye in a wasps' target area. It may be possible to discover and destroy nests within a short distance of the factory, but the effect of this would be to encourage wasps to come in on foraging expeditions from further afield—and wasp flight lines may extend as far as three miles!

The solution might seem to be some form of insecticidal spraying to make the factory wasp-proof, and this would have to be carried out inside the factory. Wasps coming into contact with the sprayed surface would die; however, while this kind of treatment is successful with flies, it would merely reduce the numbers of wasps—and this is not enough.

The problem with wasps is that (*a*) they are so numerous and (*b*) a food processing plant is an almost magnetic attraction. The wasp colony is centred on the Queen who stays in the nest, producing more and more young. The worker wasps have to forage for food and bring it back to the Queen and the larvae. In a fully developed nest at the height of the fruit season there may be as many as thirty thousand wasps.

Controlling wasps is therefore somewhat different from controlling flies which tend to be nomadic individuals with no organized community life which has to be strictly served. It is by understanding the different biologies and behaviour patterns of pests that the modern technology of pest control has been evolved in establishments such as the Rentokil Research Laboratories at Felcourt, East Grinstead. To a very large extent this new technology often depends on inducing the pests to cooperate in their own destruction, as exemplified by the "Waspex" technique of delayed-action wasp control.

A series of 300 field trials were conducted by Disinfestation Ltd. at food processing and catering premises throughout the United Kingdom in 1960. Of these trials, 159 were at bakeries, 32 at confectionery and chocolate factories, 15 at soft drink works and 12 at canneries. Detailed questionnaires on each trial were returned at the end of the wasp season and assessment of these reports showed that the measures had been 90% successful. There were one or two extraordinary results, an example being a plum orchard where the 1959 crop had been completely lost to wasps but, by adoption of the "Waspex" technique, no loss was experienced in 1960.

This technique is a combination of bait and skilful application and depends for success on three things: (1) *external* siting of the baits, (2) a specially formulated bait which does not kill for some time, and (3) the cooperation of the wasps in conveying the bait to the Queen and larvae in the nest.

To explain in greater detail, the baits are placed on sills, ledges and other suitable places all round the building. Known as "perimeter baiting" this external barrier has more than one function. It provides the wasps with food which they would otherwise seek inside the premises, and so keeps the factory clear of wasps. It also contains a carefully balanced concentration of a chlorinated hydrocarbon insecticide designed to kill by delayed action only after contamination of the nest. As a result, there is no longer any great risk of employees being stung, and the danger of dead wasps falling into the product is eliminated. The entire operation takes

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Emile Hugot, in his "Handbook of Cane Sugar Engineering" writes: "The Cuitometer is particularly useful for pans working on low grade massecuites, especially with C massecuites; but it is very useful with any massecuite, and it may be stated that today it is an indispensable instrument for the sugar boiler. Thanks to it, novice sugar boilers can boil as safely as a master boiler, and maintain the massecuite at the optimum point of supersaturation, without risk of false grain. **Each pan should have its Cuitometer. The relatively insignificant cost of this instrument permits of this.**"

(Extracted by kind permission from "Handbook of Cane Sugar Engineering" (p. 517) by E. Hugot, translated by G. H. Jenkins (Elsevier, Amsterdam). 1960. Price: 170s. 0d.).

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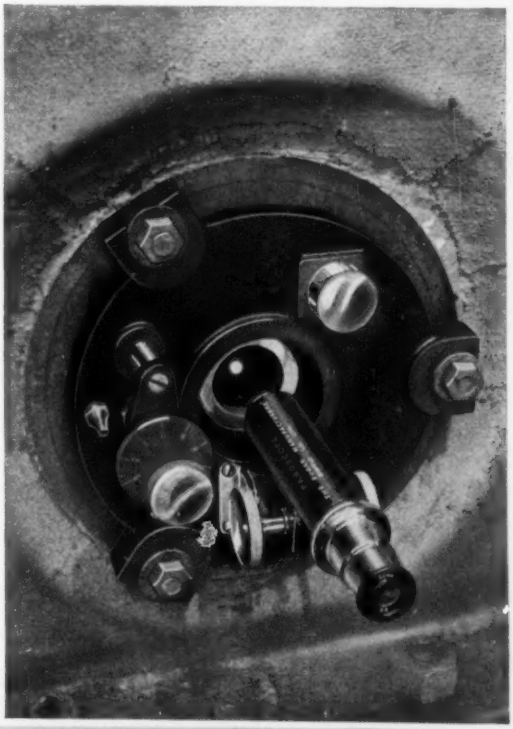

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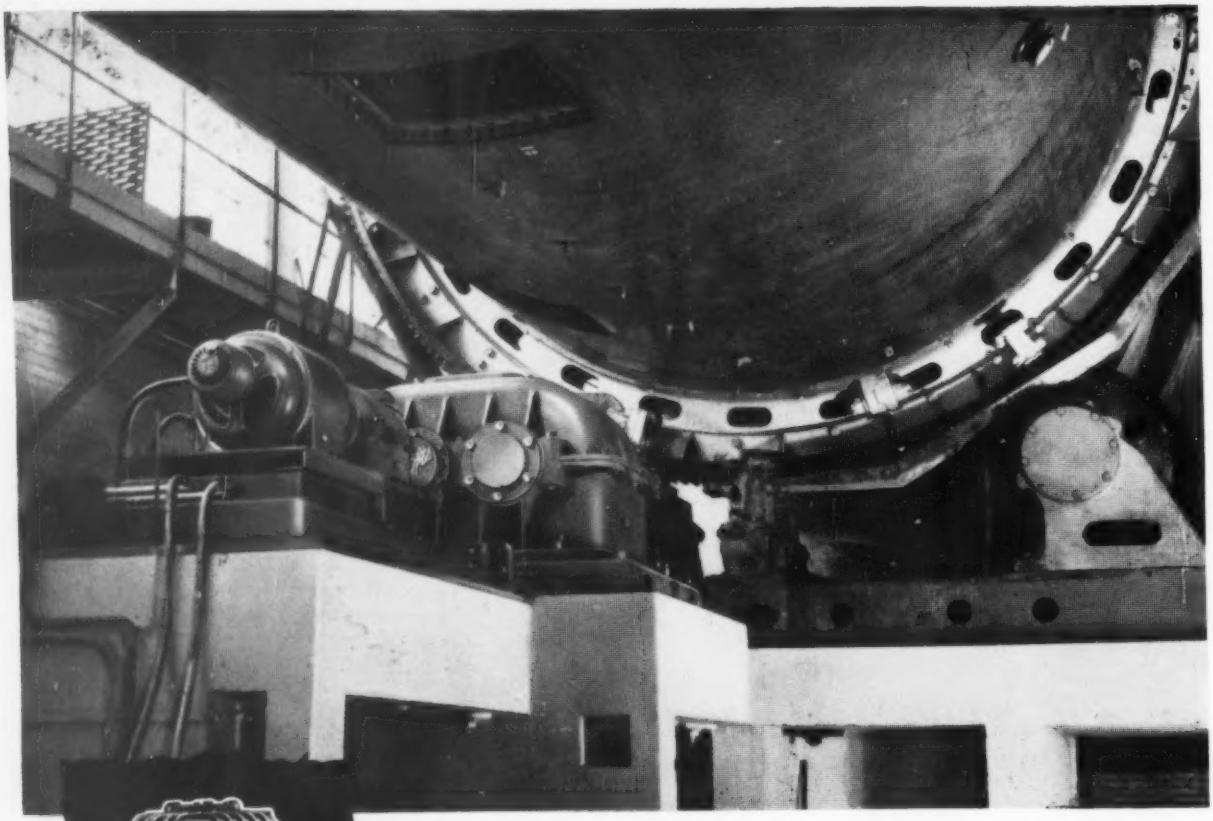

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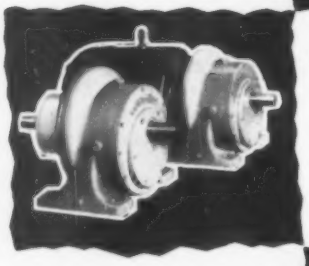

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place outside the building before the wasps can do any harm, alive or dead.

At a large sugar processing and packaging plant where this ingenious form of wasp control was on trial last August, conditions were very exacting since few places could be more tempting to wasps. Typical of the praise by management and staff was the declaration by the foreman of the packing room, where the staff were particularly enthusiastic, that "the difference between last year and this is incredible.' In previous years the skylight had been blacked-out by wasps whereas in 1960 not a wasp was to be seen. On the loading bay platform some sugar was spilt but there were no wasps about—a remarkable state of affairs since, in the past, accidently spilt sugar would have meant the platform becoming a seething mass of yellow insects.

The thirty women employed in the packeting room, where 100 tons of sugar was packed and despatched daily, were normally terrified by the wasps and it was usual for three stings a day to be recorded in the First-Aid Book. With protection of the factory by the "Waspex" system not one woman was stung last year.

As a result of study of the questionnaires returned from the 1960 field trials the baits have been modified and perfected this year. They can be used in any country with a temperate climate.

MANUFACTURE OF SUGAR MACHINERY IN INDIA

A Story of Successful Co-operation

THE factory of The New Horizon Sugar Mills Limited, which was officially opened last year at Pondicherry, India, has a capacity of 1000 to 1200 tons of cane per day, and produces white sugar by the double sulphitation process. This factory was designed specifically to meet local conditions.

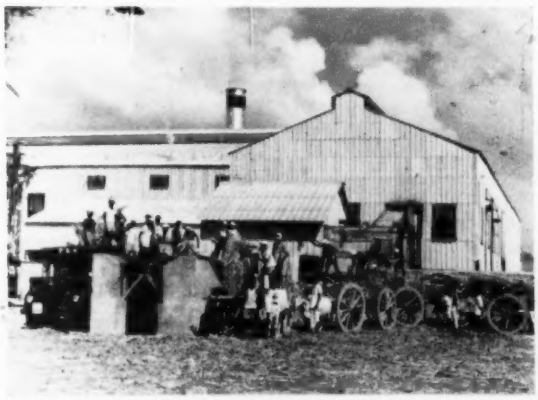


Fig. 1. Cane reception

The machinery for this factory was built partly in the U.K. and partly in India by The Mirrlees Watson Company Limited and their Associate Company in India, Messrs. Binny's Engineering Works Limited. The engineer in charge of the Sugar Factory Section of Binny's Engineering Works is a Mirrlees-trained engineer, with many years' experience of Indian conditions.

Cane is brought to the factory both by motor lorries and bullock carts, the cane carrier being loaded by hand. The cane then passes through two sets of cane knives, the first being hook knives and the second straight knives, each set driven by 150 h.p. motor. It is then delivered to the milling train, which comprises a three-roller crusher 27 in diameter × 54 in long, and three mills 26½ in diameter × 54 in long, the mills being of the latest type of construction with kingboltless-type cast steel headstocks with "Nitralloy" steel renewable plates across the face of the gap for the top roller bearings. The mills are driven through two sets of compound spur gearing by two single-stage axial flow Mirrlees steam turbines each capable of developing 375 b.h.p. The mills are fitted with Edwards-type hydraulic accumulators and the intermediate carriers have air-operated clutches arranged for remote control from a panel, which also serves the turbines as control point.

The chokeless return system for handling the unstrained return mill juice is used. The mixed juice, before passing to process, is strained in a "Peck" revolving strainer located above the mills so that the cush-cush removed drops out directly on to the intermediate carrier.

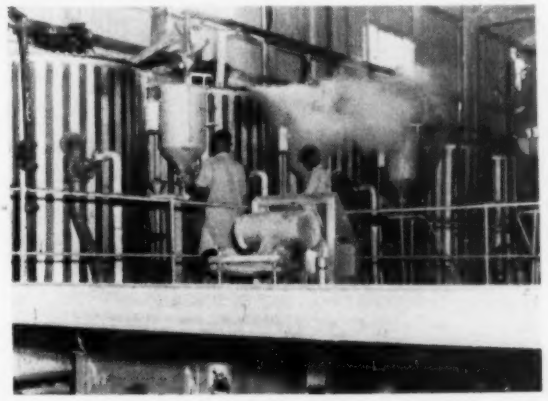


Fig. 2. Liming and sulphitation tanks

After being weighed in an automatic juice scale, the juice is pumped straight to the juice liming and sulphuring tanks; the milk-of-lime and sulphur gas being made separately and piped to the treatment tanks. The sulphur furnace used is an efficient design, made in India by Mirrlees' associates.

The limed and sulphured juice is then pumped through heaters, and after flashing-off vapour, goes to a Bach continuous subsider. In this subsider, the muds and many of the impurities are removed, while the clear juice is tapped off and passed to the evaporator. The mud from the subsider is filtered in a Dorr-Oliver vacuum filter, also made in India.

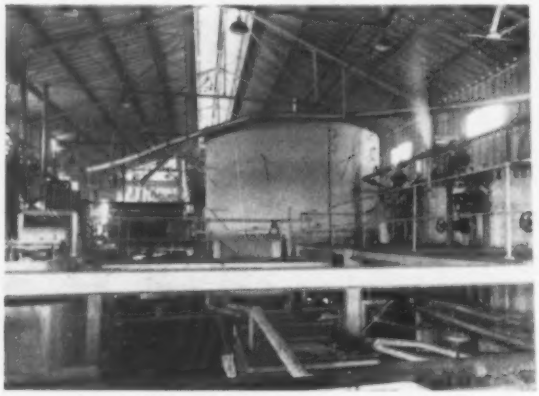


Fig. 3. Clarification House showing Bach subsider

The quadruple effect evaporator has a total heating surface of 12,336 sq.ft. with vessels of cast iron. From the evaporator, the syrup goes to syrup sulphuring tanks, and from there is pumped to the vacuum pan syrup supply tanks.

Fig. 4. Quadruple effect evaporator

There are four vacuum pans, each in cast iron, and each 10 ft in diameter, with a strike capacity of 800 cubic feet and a total heating surface of 1190 sq. ft.

"C" Sugar from the low grade pans drops into water-cooled crystallizers, with reheating incorporated. Seven are provided, each able to take the strike from one pan. After a period in the crystallizers, the "C" massecuite is double-cured in a battery of four water driven centrifugals, each 42 in × 20 in, running at 1400 r.p.m. The "C" sugar is melted and returned to the pan syrup tanks.

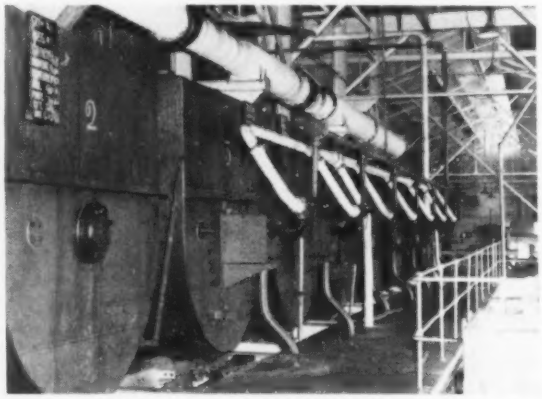


Fig. 5. Crystallizers with water-cooling and steam reheating elements (made in India)

"B" Massecuite can also be held in the crystallizers before double-curing in the "B" centrifugals. These comprise two foreworkers and one afterworker, 42 in × 20 in, running at 1200 r.p.m. "A" Sugar is held for a short time in air-cooled crystallizers and is cured in a battery of five machines, (three foreworkers and two afterworkers). The machines are 42 in × 20 in running at 1200 r.p.m. All centrifugals are water driven, the power being supplied by electrically-driven multi-stage turbine pumps. Massecuite heating elements are provided in the mixer for the "C" machines and all machines are provided with hand-operated ploughing apparatus, suitable mechanical precautions being taken to prevent the plough being used when the machines are running at speed.

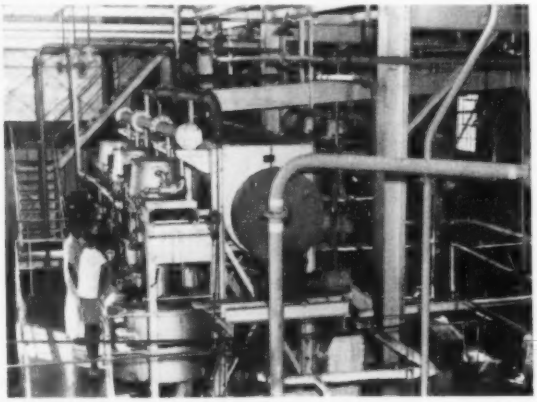


Fig. 6. Centrifugal station

The boiling house is laid out for gravity flow of massecuite from the pans to the centrifugals and suitable connexions and pumps are provided to allow different standard methods of building up the various massecuites.

The final white sugar from the "A" massecuites is delivered by grasshopper conveyor to an air cooler; then, after being screened, it passes to a storage bin, whence it is delivered to the bag weighing machines, check scale and bag sewing machine.

Barometric counter-current type condensers are provided for the evaporator and each vacuum pan, the injection water being supplied from an electrically-driven injection water driven pump having a capacity of 5000 gallons per minute. The short-stroke dry air pump is also electrically driven and has a capacity of 2500 cubic feet per minute. A Mirrlees spray cooling pond with the necessary operating pump is provided for cooling the injection water in order to conserve supplies.

Bagasse from the mills is conveyed to two John Thompson Beta-type boilers, each having a heating surface of 7500 sq. ft. and designed for a working pressure of 200 lb per sq. in. with 100°F superheat. The boilers are fitted with Thompson-Eisner furnaces, air for which is provided by motor-driven forced and induced draught fans. Return water from the various steam using units is used for boiler feed and the collection is so arranged that only a very small amount of make-up water is required. Electric power is provided by a turbo-alternator having an output of 750 kW, generating 440 volts, 3-phase, 50 cycles current.

The buildings are specially designed for free passage of air for ventilation, all openings, however, being protected by overhanging canopies. In addition, ample light is provided by suitably placed glazed windows.

The whole factory is neatly laid out, as may be seen from the photographs, and is, and has been, grinding at the rated capacity almost since the start-up.

This New Horizon factory is the second factory in India made in conjunction with Mirrlees' Indian associates, where the greater part of the machinery has been imported from this country. Since then, Binny's Engineering Works Ltd., have taken orders for three complete sugar factories of approximately the same size, and the imported content is now down to less than 20% of the total value of the machinery. One of these factories is now in course of erection, the other being well advanced in the machine shops, while the contract for the third factory has just been signed.

The Mirrlees Watson Co. Ltd. were one of the first firms to arrange for the manufacture of sugar machinery in India, and by progressing carefully in the transfer of manufacture to India, have ensured that their associates, Binny's Engineering Works Ltd., are now in a position to give a complete service in Madras to the Indian sugar industry. With a view to maintaining the close contact nceessary to utilize the experience of the home company, combined with the facilities of the Indian company, The Mirrlees Watson Co. Ltd. have taken a substantial financial interest in Binny's Engineering Works Ltd. Arrangements have also been made for certain types of plant to be made to The Mirrlees Watson Co. Ltd.'s designs in Calcutta, in association with Port Engineering Works Ltd.

CHELATION STUDIES WITH THE DIALYSED BROWNING PRODUCTS FROM CANE FINAL MOLASSES

1. Complex Formation with Copper

By W. W. BINKLEY

(New York Sugar Trade Laboratory, 37 Warren Street, New York 7, N.Y., U.S.A.)

POTASSIUM, magnesium, calcium, aluminium, sodium, iron and manganese are the principal metal cations of cane juice[1]. These are found in the final molasses as salts of organic and inorganic acids for the most part. A few of these metals form complexes with the phenolic groups of some of the naturally-occurring pigments of cane juice and the resulting iron-polyphenol products, in particular, contribute to the colour of molasses[2]. Certain carbohydrates and related substances engage also in metal-complex formation and their capacity to bind copper in this manner has led to significant deductions relevant to their ring conformation[3]. The dialysed molasses "browning" products were found to possess 6 or 7 hydroxyl groups per repeating unit[4] and it was the potential chelating activity of these polymer groups which led to the study herein reported.

[1] FORT and MCKAIG: *U.S. Dept. Agric. Tech. Bull.*, 1939, (688).
[2] ZERBAN: *Sugar Res. Foundation Tech. Rpt. Series*, 1947, (2).
[3] REEVES: *Advances in Carbohydrate Chem.*, 1951, **6**, 107.
[4] BINKLEY: *I.S.J.*, 1958, **60**, 322.

Experimental

Conductivity Measurements

(*A*) *Technique.*—The complexing agent used in these determinations was prepared by dissolving 0·976 g of copper[II] hydroxide (0·01 mole), 3 moles of ammonia, and 10 ml of ethanol in sufficient distilled water to make a litre of solution at 20°C. This solution was allowed to stand for a minimum of 48 hr at 4–6°C to permit the settling-out of insoluble substances. The supernatant liquor was used as the complexing agent. One millimole of the substance to be tested was dissolved in a sufficient quantity of this reagent (containing 1 millimole of copper) to make 100 ml of solution at 20°C. The conductivity of the resulting solution was measured in a jacketed glass cell containing platinum electrodes coated with platinum black (cell constant at 20°C with 0·1M KCl, 0·1391). The cell was used with a standard Wheatstone bridge. The resistance required to balance the circuit was established with the aid of an oscilloscope (Model 555, Radio City Products Co., Easton, Pa., U.S.A.). All measurements were made between 19° and 21°C. The values reported in Table I are those obtained at or adjusted to 20°C.

(*B*) *With the dialysed molasses "browning" polymer.* A paste formed by the addition of a few drops of the copper reagent to 202 mg of the dialysed molasses "browning" polymer (the polymer repeating unit of 405·4 g contains two hexose residues) was dissolved in sufficient reagent to make 100 ml of solution at 20°C.

(*C*) *With methyl α-D-glucopyranoside, 1,4-anhydro-D-glucitol, methyl 4,6-O-benzylidene-α-D-glucopyranoside, 2,3-O-isopropylidene-D-fructopyranose and 1-N-methylamino-1-deoxy-D-glucitol.*—An amount of 194 mg of methyl α-D-glucopyranoside, 165 mg of 1, 4-anhydro-D-glucitol, 282 mg of methyl 4,6-*O*-benzylidene-α-D-glucopyranoside, 348 mg of 2, 3-*O*-isopropylidene-D-fructopyranose triacetate and 195 mg of 1-*N*-methylamino-1-deoxy-D-glucitol was dissolved separately in sufficient copper reagent to make 100 ml of solution at 20°C.

Table I

Conductivity at 20°C of Ammonical Copper[II] Hydroxide with and without added Carbohydrate Substances

Substance*	Resistance†, ohms	Conductance, × 10^{-3} mhos
Ammonical copper (II) hydroxide	3500	2·60
Inulin	3700	2·45
1,4-Anhydro-D-glucitol	4030	2·27
Methyl 4, 6-*O*-benzylidene-α-D-glucopyranoside	4050	2·26
Methyl α-D-glucopyranoside	4070	2·25
2, 3-*O*-Isopropylidene-α-D-fructopyranoside	4080	2·24
Cane molasses dialysed "browning" products	4610	1·98
1-*N*-Methylamino-1-deoxy-D-glucitol	5660	1·61

* One millimole of substance dissolved in ammonical reagent containing 1 mM of copper.
† Cell constant 0·1391, bridge setting 15.

(*D*) *With inulin.*—An amount of 181 mg of inulin (containing 10% moisture) suspended in 10 ml of copper reagent was heated until a homogeneous solution was obtained. The resulting solution was cooled quickly and adjusted with additional reagent to 100 ml at 20°C.

Discussion

The chelating capacities of the substances studied herein were based on the magnitude of the increase in resistance (or decrease in conductance) resulting from their dissolution in ammonical copper[II] hydroxide (given in Table I). The model compounds were selected to represent both the furano- and pyranohexose ring configurations. The D-fructofuranose structure, represented by inulin, was able to chelate copper ions slightly. The D-gluco-furanose ring, using 1,4-anhydro-D-glucitol as the model, exhibited greater activity and its complexing capacity was found to be equal to that of the compounds containing the pyranose configuration. The reduction in the conductivity of the copper reagent by the D-fructopyranose derivative with hydroxyl groups available at carbons 3 and 4 was equal to that created by the D-gluco-pyranose structures with uncombined hydroxyls at carbons 2 and 3 and 2, 3, 4. The copper binding capacity of the dialysed molasses "browning" polymer was significantly greater than that of the model substances bearing no nitrogen but markedly less than that of 1-*N*-methylamino-1-deoxy-D-glucitol (*N*-methylglucamine). This amino-hexitol possessed, in addition to complex-forming hydroxyl groups, the carbon-nitrogen-carbon arrangement at carbon-1 found in the products of the initial step of the amino-acid-hexose polymerization[5]. The conductance change (0·62) brought about by the polymer was nearly that calculated for an equal molar mixture of a hexose derivative bearing no nitrogen and the *N*-methylamino-hexitol $\left(\frac{0{\cdot}35 + 0{\cdot}99}{2} = 0{\cdot}67\right)$. The chelating properties of the polymer(s) are attributable in part to the location of its hydroxyl groups and to certain features in connexion with its constituent nitrogen.

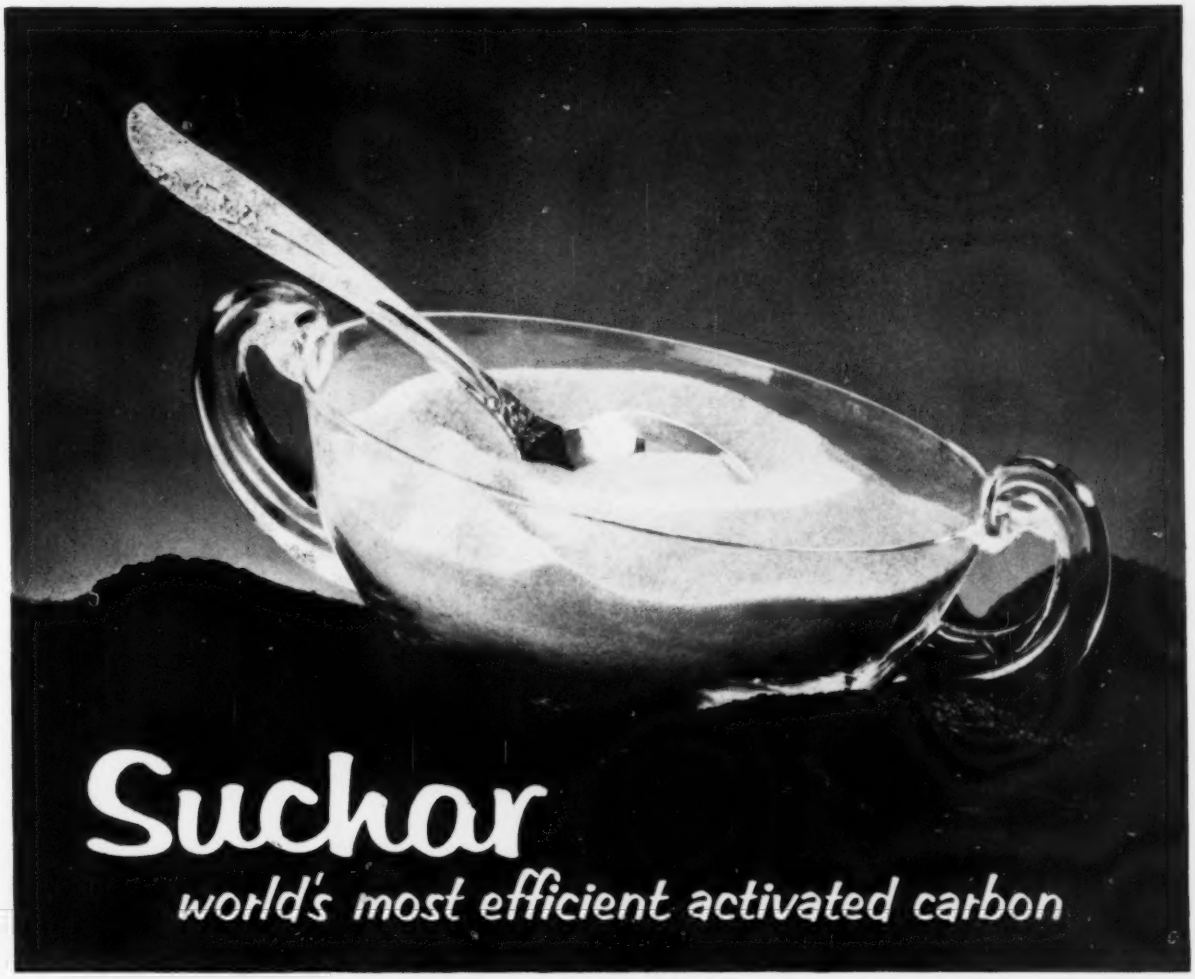
Summary

The dialysed molasses "browning" products were able to chelate copper ions. Their metal-complexing capacity was greater than that of model carbohydrate derivatives bearing no nitrogen but less than that of 1-*N*-methylamino-1-deoxy-D-glucitol. The ability of the molasses polymer(s) to form these complexes is attributed in part to the location of its hydroxyl groups and to certain structural features of its constituent nitrogen.

Acknowledgment

The writer wishes to thank Mr. James Martin, of this Laboratory, for his assistance in a portion of the experimental work.

[5] Dubourg and Devillers: *Bull. soc. chim. France*, 1957, 333.



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CALCIUM CHLORIDE AS AN AID TO PULP PRESSING

By A. CARRUTHERS and J. F. T. OLDFIELD

Paper presented to the 14th Technical Conference, British Sugar Corp. Ltd., 1961.

PART I

Introduction

IN the 1956/57 campaign, calcium chloride was applied experimentally to spent cossettes at several factories of the British Sugar Corporation to investigate possible effects on pulp pressing. At that time the quantities of calcium chloride employed were equivalent to about 30 lb per 100 tons of beet and the use of such amounts was examined in an earlier report[1]. It was found that, during diffusion, calcium ions were readily absorbed by exhausted cossettes at the water end of the system while calcium was desorbed to a limited extent at the juice end of the diffuser. Only about 10% of the calcium in fresh cossettes was extracted during diffusion but the spent cossettes were capable of absorbing calcium equivalent to at least 150 lb of anhydrous calcium chloride per 100 tons of beet. In contrast the chloride ion distribution between the spent cossettes and the surrounding liquor did not indicate any preferential absorption.

The calcium absorption was accompanied by desorption of other cations from the cossettes. The cation equilibrium was influenced by the ionic strength of the supply water and in particular a high ammonia content delayed the calcium uptake.

It was pointed out in the earlier report that calcium absorption occurred at the water end of all diffusers, because the raw water used as make-up contained calcium, and the calcium added as calcium chloride was small in comparison with the calcium present as natural hardness in the make-up water. The effects, if any, of these small calcium chloride additions could not be assessed with confidence because of the normal fluctuations in the moisture content of pressed pulp.

In the 1960/61 campaign, much heavier calcium chloride additions were employed at some factories and it became evident that additions of about 200 lb of calcium chloride per 100 tons were accompanied by an increase in pressed pulp dry substance to an extent greater than that which could be attributed to natural fluctuation.

The effect of these higher additions, both on pulp pressing and on juice quality, were therefore examined.

Calcium concentration in diffusion supply water

The flake calcium chloride, as used at several factories, was analysed and found to contain approximately 70% anhydrous calcium chloride and free alkalinity equivalent to 0·3% CaO.

If calcium chloride is added to the make-up water at a rate equivalent to 200 lb per 100 tons of beet, this free alkali is only 0·2 meq/litre which is insignificant in comparison with the ammonia alkalinity of 2–5 meq/litre in the make-up water.

At a factory operating with make-up water equal to say 45% on beet and press water say 60% on beet, if flake calcium chloride is dissolved in the make-up water at a rate equivalent to 200 lb per 100 tons of beet, the calcium ion content of the make-up water would be increased by about 500 p.p.m. If no calcium were absorbed by the pulp, the calcium content of the press water would increase and tend towards a maximum value of 500 p.p.m. and therefore the calcium content of the supply water could not exceed 500 p.p.m. Alternatively, if the added calcium were completely absorbed by the pulp, the press water would contain no calcium and the calcium content of the supply water would be about 200 p.p.m.

In practice therefore the addition of 200 lb of flake calcium chloride per 100 tons of beet will increase the calcium content of the supply water to some value between 200 and 500 p.p.m. depending on the efficiency of calcium absorption.

Treatment of spent cossettes with calcium chloride

Spent cossettes were produced by diffusion in the laboratory micro-battery using town water as the battery supply. The spent cossettes were drained to about 5% dry substance and mixed thoroughly. Samples were then equilibrated for one hour at 70°C in water and in different concentrations of calcium chloride solution. Since it is difficult to press small samples of pulp under reproducible conditions, the pulp was separated from the superficial liquor by spinning in a basket centrifuge for 5 minutes.

In a typical experiment 550 g samples of spent cossettes were equilibrated with 700 ml of (A), distilled water, and (B – D), calcium chloride solutions equivalent to approximately 100, 200 and 400 p.p.m. as Ca^{++}. Analytical grade calcium chloride has a slightly acid reaction and the solutions were adjusted to pH 7 before addition to the spent cossettes.

The analytical data for the applied solutions and for the liquor spun from the pulp are recorded in Table 1, in comparison with the dry substance of the spun pulp.

It is not suggested that the dry substance of the spun pulp is representative of dry substance which

[1] CARRUTHERS & OLDFIELD: *I.S.J.*, 1957, **59**, 277–281.

Table 1

Absorption of calcium by spent cossettes

Treatment	No Calcium		Ca^{++} = 99 *p.p.m.*		Ca^{++} = 194 *p.p.m.*		Ca^{++} = 391 *p.p.m.*	
	Input	*Ouptut*	*Input*	*Output*	*Input*	*Output*	*Input*	*Output*
Liquor Analysis:								
Volume .. .. ml	700	950	700	985	700	990	700	1000
Total Ca^{++} .. .. .. mg	0	9	69	30	136	61	274	148
Total Cl^- .. .. mg	0	21	114	126	239	225	482	426
Total K^+ .. .. mg	0	61	0	95	0	119	0	132
Total Na^+ .. .. mg	0·7	6	1·3	14	1·6	12	2·3	13
Total Mg^{++} .. .. .. mg	0	13	0	26	0	40	0	58
pH	7·0	6·31	7·0	5·97	7·0	5·87	7·0	5·78
Spun Pulp Analysis:								
Dry Substance .. .. .. %		12·82		13·1		15·1		16·2

would be achieved in the factory process, but the increase in spun pulp dry substance with increasing calcium addition indicated that water is more readily removed from the pulp after calcium treatment.

Calcium ions are shown to be readily absorbed by the pulp. Although the amount of liquor remaining in the pulp was only 20%—16% of the amount of liquor spun from the pulp, about 50% of the added calcium at each level was transferred to the pulp. In contrast, at the lowest level of calcium chloride addition, chloride was still desorbed from the pulp and even at the highest level of addition only 11% of the chloride was transferred to the pulp.

Absorption of calcium ions without a corresponding absorption of chloride ions would be accompanied by a considerable fall in the pH of the surrounding liquor unless other cations were desorbed to maintain ionic balance. It is shown, however, that potassium and magnesium ions are desorbed from the pulp in increasing amounts as the calcium application is increased. Sodium ions are also desorbed by the calcium chloride treatment but the total reserve of sodium in spent cossettes is low and no additional sodium was desorbed at the higher levels of calcium application.

Since only the principal inorganic cations were determined, a complete ionic balance is not possible, but addition of calcium chloride solution at pH 7 was accompanied by a reduction in pH of the external liquor, showing that additional hydrogen ions were required to maintain the balance.

The ultimate distribution, between pressed pulp and raw juice, of added calcium chloride and of any desorbed ions is of considerable importance in factory diffusion because the molasses production may be increased by any additional non-sugars in raw juice. In the single stage treatment, half of the calcium ions were not absorbed by the pulp but, in factory diffusion, the calcium which is not absorbed on first contact with the pulp, will be brought into contact with fresh pulp in the next compartment or cell of the diffuser. A high efficiency in the overall absorption of calcium may therefore be expected. Chloride was not preferentially absorbed in the single stage treatment and potassium and magnesium were desorbed but these additional ions in the external water would not be expected to pass quantitatively into raw juice. The diffuser is a counter-current extraction apparatus when considered from the water end as well as from the juice end and, by simple diffusion, excess ions in the water stream will be extracted by the pulp just as excess sugar and soluble material is extracted from the cossettes by the juice stream. RODGERS[2] has applied Fick's Law to calculate how much of the sugar, returned to the water end of the diffuser in press water, will be recovered in raw juice. Absorption of calcium and desorption of other ions however must take place to a varying degree in many compartments of the diffuser, so that the concentrations of these ions will not correspond to the laws of simple diffusion; accordingly it is not possible to deduce how much of the excess ions will pass into the raw juice by analogous calculations.

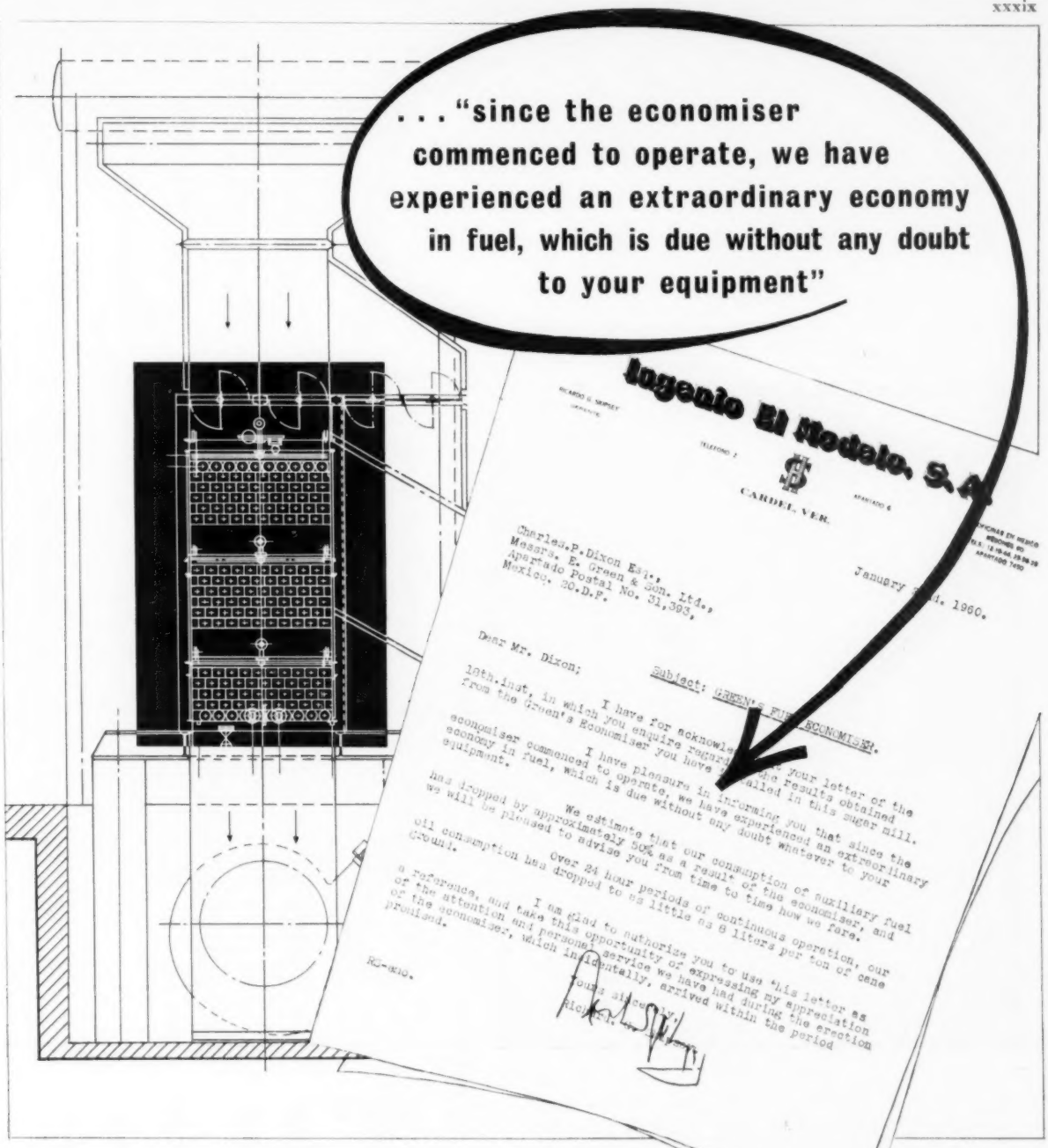
The extent to which calcium treatment may affect juice quality, either through incomplete absorption of calcium chloride or by desorption of other ions from pulp, will be influenced by the concentration of calcium and of other ions in the exhausted pulp during normal diffusion. As it is difficult to reproduce the efficient extraction and the return water system of the modern continuous diffuser in the laboratory, it is preferable to assess the effects of calcium chloride by experiments in the factory.

Effect of calcium chloride on pulp pressing efficiency

That large additions of calcium chloride can produce a significant increase in pressed pulp dry substance, may be illustrated by the data from one factory where calcium chloride was applied for periods of 2–3 weeks alternating with periods when calcium chloride was not employed. The data, recorded in Table 2, are the mean values of daily results made available by the courtesy of the works chemist, Mr. D. BEATTIE. At this factory it is not possible to dry the entire production of pressed pulp if the water content is unduly high and so, subject to any variations in slice, the production of dried molassed pulp is also indicative of pulp pressing efficiency.

In the early period of the campaign, applications of about 30 lb calcium chloride per 100 tons of beet did not produce any obvious effect on pulp pressing. At this factory the natural calcium content of the make-up water is equivalent to approximately 40 lb of calcium chloride per 100 tons of beet and it is

[2] *Paper presented to the 2nd Tech. Conf., British Sugar Corp.*, 1949.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we will be pleased to advise you from time to time how we fare.
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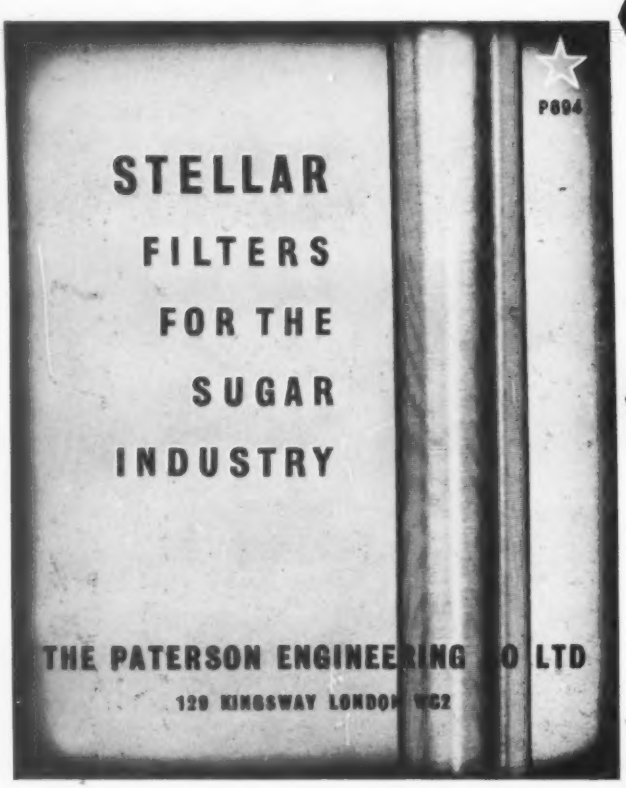

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Table 2

Effect of calcium chloride on pulp pressing efficiency (1960-61)

Period	*Calcium Chloride lb/100 tons beet*	*Pressed pulp Dry substance %*	*Beet sliced tons/day*	*Molassed pulp production tons/day*
4 Oct. – 30 Oct.	28	17·1	2128	117
30 Oct. – 11 Nov.	0	17·4	2147	114
12 Nov. – 23 Nov.	34	17·5	2150	115
24 Nov. – 25 Nov.	0	17·2	2168	114
26 Nov. – 18 Dec.	32	16·7	2114	114
19 Dec. – 26 Dec.	84	17·8	2146	125
27 Dec. – 3 Jan.	0	16·7	2075	114
4 Jan. – 13 Jan.	85	17·5	2121	120
14 Jan. – 19 Jan.	0	16·4	2006	112
24 Jan. – 3 Feb.	126	18·4	1930	120
4 Feb. – 7 Feb.	0	17·7	2100	120
8 Feb. – 19 Feb.	120	18·3	2028	116

perhaps hardly surprising that the effects, if any, of the relatively small addition of calcium chloride, are not detectable amid the natural fluctuations.

Later in the campaign, calcium chloride was applied at a rate of about 85 and 125 lb/100 tons. More dried molassed pulp was produced during the periods of treatment, except in the closing days of the campaign, and although the fluctuations for any particular treatment are too great to permit a precise assessment, it appears that the higher levels of calcium chloride were associated with increased pressed pulp dry substance of the order of some 1–2%.

At a second factory, the calcium chloride was applied at a moderate rate for the first two months of the campaign and at a very high rate for the final three months of the campaign. The calcium usage and the dry substance of pressed pulp are recorded for monthly periods in Table 3. These values are the means of the daily result which were kindly made available by Mr. MATISCHEK.

Table 3

Comparison of pressed pulp dry substance and calcium chloride usage (1960-61)

Month	*Calcium Chloride lb/100 tons beet*	*Pressed pulp Dry substance %*
October	86	16·4
November	76	16·2
Mean	81	16·3
December	193	17·2
January	210	17·8
February	236	19·1
Mean	213	18·0

It is obvious that the increased usage of calcium chloride was associated with an improvement in pressed pulp dry substance but the data also illustrate the difficulties of assessing the magnitude of the improvement. If the results for February are compared with those for November, it might be considered that the higher level of calcium chloride increased the dry substance by nearly 3%, while a comparison of the December and October figures would suggest an increase of only 0·8%. The mean increase of 1·7%, associated with the higher levels of calcium chloride, may be either an over-estimate or an under-estimate of the real effect of calcium chloride.

These uncertainties arise because it is not possible to establish, for either factory, what the pressed pulp dry substance would have been, for any particular period, if the calcium chloride treatment had been different. Accordingly, the effects of calcium chloride cannot be precisely distinguished from any long term changes in pulp pressing efficiency due to other causes.

(*To be continued*)

Correspondence

DILUTION INDICATORS IN MAURITIUS

To: The Editor,
International Sugar Journal Ltd.

Dear Sir,

I have read with interest in your March issue[1] an abstract of my Technical Circular No. 12 entitled "Weight and Polarization Changes of Raw Sugars Exported to the Uniked Kingdom" and dated July 1959. Since then, however, appropriate action has been taken by the Mauritius Sugar Syndicate to remedy the situation, as described briefly hereunder.

In September 1959 the Sugar Syndicate decided to exercise strict contol on the Dilution Indicators of all the raws exported. Unfortunately, about half of the crop had been harvested by then.

In 1960 the control was exercised throughout the crop, with the result that less than 3% of the 193,934 metric tons of sugar exported had Dilution Indicators exceeding 45.

In spite of these encouraging results, the Sugar Syndicate has decided to exercise a stricter control and has recently recommended that a penalty system similar to but more severe than that in use in Australia be enforced as from the 1961 crop. The scale of penalties adopted is as follows:—

Dilution Indication	*Penalty*
45 — 50	Rs. 5/metric ton
50 — 60	Rs.10/metric ton
In excess of 60	Rs.20/metric ton

It is thus clear that the sugar producers of Mauritius are not only aware that the keeping qualities of a few consignments of raws shipped in the past were not very satisfactory, but have taken appropriate measures to remedy the situation.

Yours faithfully,

J. DUPONT DE R. DE SAINT ANTOINE
Sugar Technologist.

Sugar Industry Research Institute,
Réduit, Mauritius.

[1] *I.S.J.*, 1961, **63**, 92.

Again: imbibition. K. DOUWES DEKKER. *S. African Sugar J.*, 1961, **45**, 54–63.—The importance of improving imbibition efficiency in South African mills is emphasized and a "dilution ratio" proposed for comparative purposes. This is based on actual drop in Brix from juice in cane to juice in bagasse, compared with a target drop empirically set at 85% for the Brix of juice in cane. Factors affecting the dilution ratio are discussed, and values calculated using Queensland data reported by LORD & DAVIS[1] for the same cane crushed in a 3- and a 4-mill tandem; these confirm the usefulness of the ratio in judging the effect of imbibition. The technique described by RIVIÈRE[2] using "macerotors"[3] for application of imbibition water is referred to. A comparison is drawn between Queensland data for 1948 and 1957, during which time the previously-used maceration tanks were discarded; a fall in dilution ratio from 72 to 65 is considered to cast doubt on the wisdom of the removal of the tanks. The Khainovsky view that ineffectiveness of imbibition was caused by inaccessibility of the juice in unopened cells has been questioned, and bagasse samples, sieved into fine and coarse particles (through and retained by a ½-in sieve), were analysed for sucrose and moisture. While moisture was almost the same for each, the finer particles contained 2·21% sucrose on average compared with 4·27% for the coarser. Improvement of milling extraction by increasing maceration may be aided by using a higher roll speed, while another important aspect is the advantage of improved feeding whether by use of high feed chutes or continuous pressure feeders. When considering the economics of steps necessary to improve extraction, it should be recognised that, above a certain extraction, juice purity will fall and recovery became more expensive.

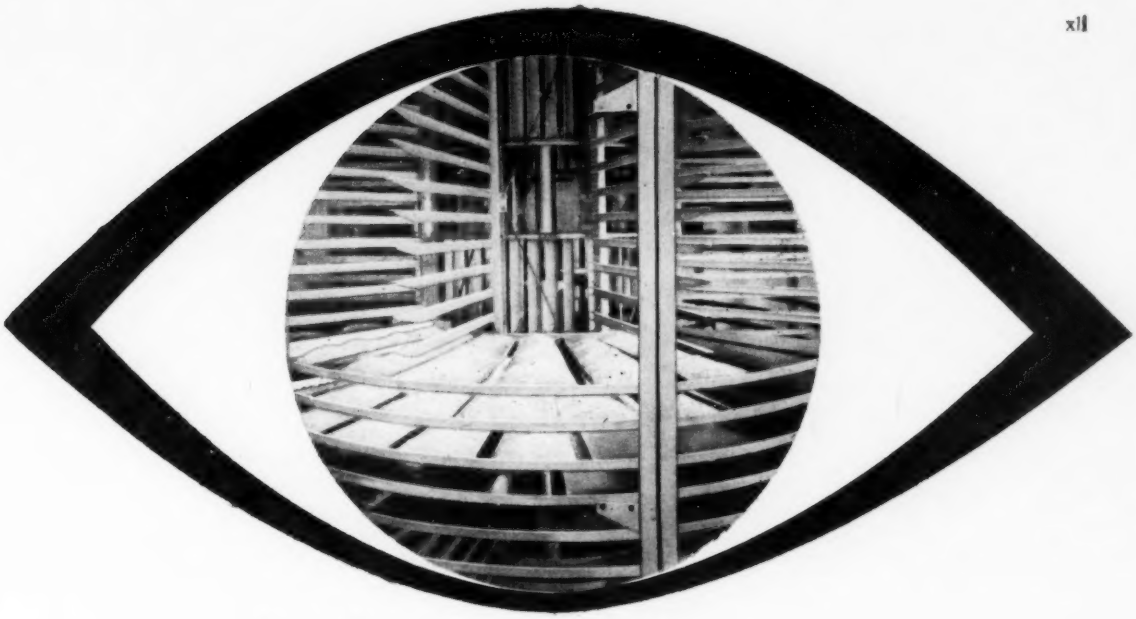
* * *

Oil separators. C. G. M. PERK. *S. African Sugar J.*, 1951, **45**, 63–65.—An account is given of devices designed for the removal of oil from steam engine vapours so as to prevent steam-side fouling of evaporators.

* * *

Factory research in Hawaii. ANON. *Rpt. H.S.P.A. Expt. Sta.*, 1960, 29–33.—Cane diffusion experiments at Kekaha indicated that standard commercial machinery will reduce cane to a sufficiently fine state for juice extraction with water. Average extraction was 96·9% (98·8–95·6%), with dilution of 38–52% on absolute juice. Under optimum conditions 98% extraction at 45% dilution is possible. Clarification of the juice obtained was as with normal mill juices, and the resultant sugars were of comparable quality to those from mill juices. Refining tests at Crockett proved that the sugars were somewhat better than sugars from mill juices because of a lower ash content. Apart from higher extraction, diffusion enjoys the following advantages: lower capital costs, power requirements and maintenance costs. Detailed diffusion data are given. Quantitative determination of non-sucrose substances in sugar crystals indicates that water is present both inside and on the surface of the crystal, Confectioner's A granulated (small crystal) containing 0·047% moisture inside and 0·01% outside and Con. A (large crystal) containing 0·157% and 0·005% respectively. A diagram is presented of the high-vacuum system for measurement of the internal moisture. Results of an ion-exchange procedure for separation of the inorganic cations in the crystal are tabulated for commercial sugar of high and low crystal colour. The results indicate inclusion as a major factor in crystal quality. Statistical analysis of statewide results of starch determination in the crystal gives a correlation coefficient of 0·70 between starch and the filtration rate, indicating that half of the variation is attributable to starch. For the island of Hawaii the coefficient is 0·27, indicating that starch is a very minor factor accounting for only 7·4% variability in the filtration rate. Chromatograms are presented of other polysaccharides in the sugar crystal. A fractionation technique has been developed for separating colouring compounds in the crystal, using dimethylformamide as solvent. Results show the relationship between colour and: (1) phenolic and polyphenolic substances, (2) ketoses and degradation of reducing sugars, (3) amino compounds, and (4) some inorganic constituents. The colour and intensity vary with the physical and chemical states of the compounds and the degree of their interaction. Final tests completed on the "Mercone" continuous centrifugal have shown that it can handle commercial massecuites at up to 4 tons/hr. The sugar is of acceptable pol and moisture content but some crystal breakage occurs; however, breakage may be kept at a sufficiently low level by modifying the design. A new technique for crystal colour measurement has been developed and will probably be recommended as standard this year. In crystallization rate studies, a syrup of 86·33 purity had a rate of 393 mg/sq.m./min compared with 314 mg/sq.m./min for a syrup of 81·85 purity (at identical sucrose:water ratios). KCl added caused a decrease in the rate comparable to

[1] *I.S.J.*, 1960 **62**, 245.
[2] *I.S.J.*, 1961, **63**, 211.
[3] MAXWELL: "Modern Milling of Sugar Cane. (Norman Rodger, London.) 1932. p. 319.



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that in pure sucrose solutions. Glucose had no appreciable effect beyond the effect of KCl. The effect of KCl and $CaCl_2$ on the rate of crystallization from sucrose solutions at 55°C was similar to that at lower temperatures in that KCl reduced the rate and $CaCl_2$ increased it. Addition of 2 p.p.m. of "Separan AP-30" to factory juice had no significant effect on sugar filtrability or crystal colour.

* * *

Criteria to compare efficiency. R. H. TSENG. *Taiwan Sugar*, 1960, **7**, (10), 13–15.—For the 27 mills of the Taiwan Sugar Corporation the following criteria are proposed: a molasses purity of 28 and a yield of 2% on cane ground; a bagasse pol of 1·5°; a filter-cake pol of 1·0 and unknown losses of 1·0%. Achievement of these targets by all factories would mean a 60,000 tons increase in sugar production based on an annual production of 1 million tons. Targets of 8 kg of bagasse saved per 100 kg cane ground for raw factories and 4 kg per 100 kg for carbonatation factories are also set.

* * *

The "Sucroscope." Z. NITSCHE. *Gaz. Cukr.*, 1961, 1961, **63**, 7–10.—Three pan boiling instruments are described: the "Nife Preisler" KP-2 projector manufactured by the Swedish firm Svenska Ackumulator AB. Jungner, the "Panoscope" of the Sugar Manufacturers' Supply Co. Ltd., of London, and the "Sucroscope" manufactured by the German firm of H. Putsch. The last of these is described in detail with diagrams and is recommended on the strength of results obtained in Michalów sugar factory.

* * *

Some studies on sugar cane clarificants. T. R. SUBRAMANIAM. *Madras Agric. J.*, 1958, **45**, (2), 67–71; through *S.I.A.*, 1960, **22**, Abs. 1202.—Gur was prepared from juice clarified with soyabean tablets, castor seed extract or groundnut seed extract, either with or without added lime, or with lime alone. The lime was added to a pH of 6·1–6·4. Samples of the gur were analysed and the results are tabulated. Lime alone gave the best results; the vegetable clarificants were more effective in the presence of lime than in its absence.

* * *

New cane mud filtration process and mixed juice screening. R. RAMOS. *Sugar J.*, (La.), 1961, **23**, (8), 9–16.—The Dorr-Oliver "Rapi-Floc" process of mud filtration has been tested at Central Plata, Puerto Rico. A polyelectrolyte, "Dowex AP-30", is used as coagulant, the stock 0·5% solution being diluted to 0·05% concentration before adding. Mud pH is adjusted to 7·5–7·8 and its particles coagulated in a special tank. It is filtered on a slightly modified Oliver filter having a very porous "Dacron" filter cloth over the existing perforated plates. The filter-cake is removed by a flexible scraper. About 35–40 lb of wet cake per sq. ft. was produced per hr compared with 20 lb/sq. ft. in conventional filters (both of about 80% moisture content). Cake thickness was about $\frac{3}{4}$ in compared with $\frac{1}{4}$–$\frac{1}{2}$ in for filters with normal cachaza feed. Optimum pH range was 7·5–8·5, at which filtrate clarity was the same as the average clarified juice clarity. Sucrose content of the cake was 1·7–3·3%, usually 2·0–2·5%, and washing presented no difficulties; wash water requirement was 30–35 g.p.m. more than with conventional filters because of the continuous washing with high velocity jet nozzles. Cloth life will be at least 1 month. The Brix of the filtrate was lower than usual, although purity was considerably higher. Experiments were also carried out on secondary screening of mixed juice with two Dorr-Oliver DSM screens. Fibre size determinations were not possible, although approximate evaluation indicated that most of the fibre was removed. Clarifier capacity increased, permitting one unit to be left idle for most of the season. The clarified juice clarity was better than previously, a thicker mud resulting. At the filter station 3·78 tons of cake were produced per 100 tons of cane compared with 5·97 in 1959, the cake pol was 1·86 compared with 3·49 and the pol lost % pol in cane was 0·82 compared with 2·59.

* * *

A new idea in the maintenance of vacuum in pans. A. L. WEBRE. *Sugar J.* (La.), 1961, **23**, (8), 23–26.—To maintain constant vacuum in the pans the following suggestions are offered: each pan should have its own condenser; the vacuum pump connexions should not be too large; ejector condensers may be used (these do not require vacuum pumps but present certain snags); one large vacuum pump should be used for all condensers, with a smaller one to raise the vacuum in each pan; steam jet vacuum pumps may be used on each pan condenser, but the high live steam wastage should be borne in mind; water jet vacuum pumps are recommended as being very simple, reliable and of low initial costs; these are described in detail.

* * *

One of the world's most modern mills at Victorias Milling Company. E. R. DE LUZURIAGA. *Sugar J.* (La.), 1961, **23**, (8), 28–32.—The 18-roller ($37\frac{1}{2} \times 78$ in) Farrel mill tandem with individual turbine drives that has been installed at Victorias is described in detail together with the ancilliary equipment, including the 30 m. ton Howe scales for weighing rail cars.

* * *

Improving the quality of bagasse for its fuel value. B. B. BANDI. *Indian Sugar*, 1960, **10**, 599.—A 15% reduction in weight resulted when bagasse of 47–48% moisture content was placed in an oven for 1 min at 180°C. On the basis of this, the author suggests a bagasse drying device essentially like a sugar dryer and heated by flue-gases. A dust catcher would be provided and the moisture content of the bagasse would be reduced by 12%. This would avoid the necessity of using supplementary fuels.

Separation of the flock of preliming. Results obtained at the Raffinerie Notre-Dame at Oreye during the 1960 campaign. R. VANDEWIJER. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—Modifications of the scheme described earlier[1] were carried out and applied during the 1960 campaign. These were to permit gassing of the prelimed juice in a separate tank after heating to 85°C, together with recirculation of the 1st carbonatation juice sludge to preliming. The thick juice purity obtained was better than in 1958 in spite of reduced lime usage, although the ash increase was greater.

* * *

Pulp pressing. S. A. MORRISH. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—An account is given of continuing trials with the Stord pulp presses at Peterborough and Ely factories. Pulp dry matter rise was maintained at a satisfactory level. Epoxy resin coatings of the spindles and flights were eroded, allowing corrosion of the mild steel to take place. Distortion and rupturing of the screen in places may be due to either the presence of small stones in the pulp or to the high pressure; the screens may be modified to prevent this. Trials were made with two scrolls, separately driven at differing speeds within the same housing. These indicated that a higher dry substance is obtained compared with the standard single-scroll press, but at high feed rates pulp tended to squeeze out at the input end.

* * *

Proposals for future heat economy. N. M. ADAMS and N. R. TWAITE. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—Theoretical calculations are made of the steam savings resulting from reduction of draught. Other savings are found by reducing heat losses in the factory, use of all available heat from condensates, and use of waste heat for heating purposes. An example of the last is the use of continuous counter-current double pre-scalders and three design proposals are briefly discussed, together with a note on size calculation, and methods of using part of an existing RT or tower diffuser as a pre-scalder. Estimates are made of the minimum factory steam requirements for plants making white and raw sugars: these are 31% and 23% steam on beet. The importance of reducing the steam sent to the evaporator condenser is emphasized, and improvement of the classic static evaporator discussed, with mention of the climbing-film evaporator particularly in use as a preliminary effect, converting a quintuple into a sextuple-effect evaporator. Finally a review is made of thermo-compression by turbine or jet compression with details of savings possible and existing installations, in particular those at Hougaerde, Etrepagny, and Aulnois-sous-Laon. The existing heat balance at Ely factory, where a high pressure boiler and a turbo-alternator are to be installed, is discussed together with the changes resulting from and economics of the use of thermo-compression.

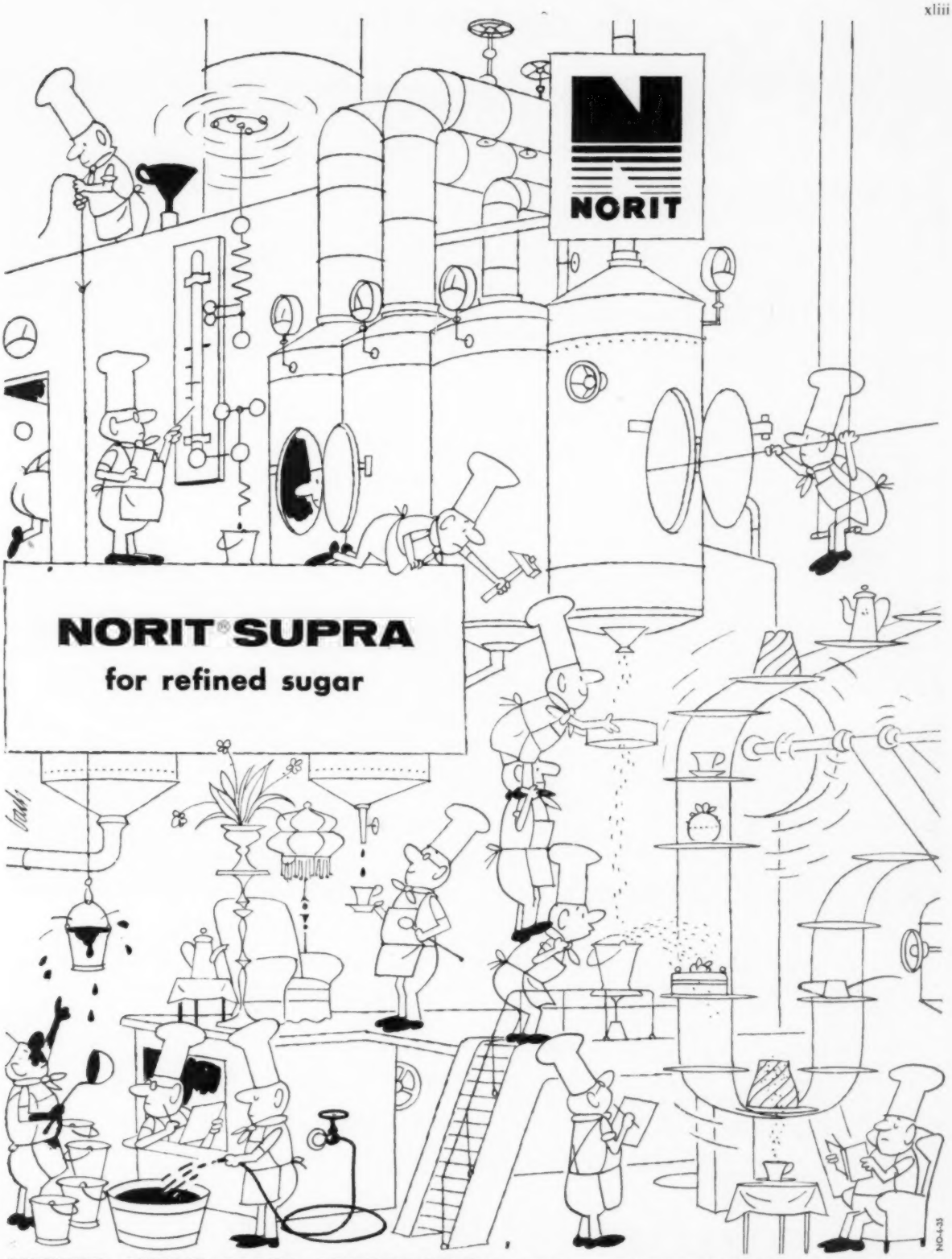
* * *

The technical value of sugar beets in 1960. J. HENRY, R. VANDEWIJER and R. PIECK. *Paper presented to the 14th Tech. Conf., British Sugar Corp. Ltd.*, 1961.—An account is given of trials carried out during the 1960 campaign to study the influence on beet analysis of increasing K and N fertilizer, and a study of field homogeneity by intra-field sampling. Results, which are amply illustrated in graph form, are also compared with data collected during 1959[2]. It was apparent that as between a wet and a dry year, differences were quantitive rather than qualitative, and conclusions drawn in the previous campaign were valid for 1960. There was little significant effect as a result of increasing K fertilizer, although serious changes in juice composition resulted from an excess of N. Again, the field factor proved to be the most important factor affecting beet and juice quality. The effect of harvesting date was surprisingly great, a 10% increase in sugar yield occurring between October and November. A highly significant relationship was observed in both years between brei conductivity and the ash content of clarified juice; this might develop to a means of predicting sugar and molasses yields for a particular factory from beet analysis.

* * *

Examination of a Buckau-Wolf continuous diffuser at Salinovsk sugar factory. E. T. KOVAL', A. YA. ZAGORUL'KO and A. A. LIPETS. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 19–42.—The Buckau-Wolf tower diffuser is described and results are given of tests with a 1500 tons/day unit (4 m dia.) during two campaigns. The optimum cossette length was 11–13 m/100 g. At a sugar content of 15–16% without return of press-water the optimum draught was 115–120% or 125–130% for a sugar content of 18–19%. With fresh beet the circulation juice temperature should be 78–80°C, that of the tower juice 71–73°C and of the condensate feed water 68–70°C. For normal conditions the rotary speed should be 0·5–0·65 r.p.m. A cossette loading of 70 kg/hectolitre is recommended. For high throughputs and cossettes

[1] *I.S.J.*, 1960, **62**, 322.
[2] *Sucr. Belge*, 1961, **80**, 173–193, 218–234, 265–288, 313–330.



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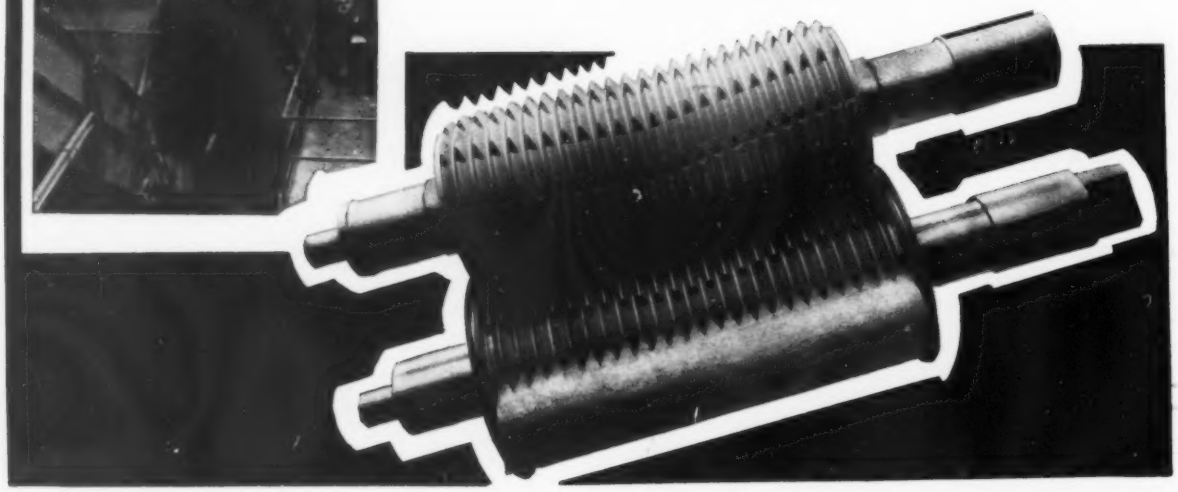

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of low elasticity modulus, the filter screens should be modified. Considerable intermixing of cossettes may be overcome by attaching "fins" to the scroll blades or by constructing a conveyor element with a large number of overlapping blades. At a daily throughput of 1150 tons of beet, the average retention time is 86·5 min. To increase efficiency 150–200 mm tubes should remove the foam from the scalder and pass it to a foam destroyer. A cover should be placed over part of the cossette-juice mixer and the scroll to exclude air. D.C. motors should be installed at the slicers and connected to the belt weighers in order to ensure regular cossette flow to the diffuser. Pulp yield was 70% and losses 0·49% on weight of beet at a draught of 124%. The average temperature was 66°C, cossette length 11·8 m/100 g and the sugar content 19·42% (without press-water return). At a temperature of 68–70°C in the diffuser, formalin should be added. The advantages of the diffuser are: stability with processing of fresh beet; low floor-space and labour requirements (1 operator); ease of repairs. Disadvantages include: difficulty of attaining low loss figures without return of press-water and instability when processing stale and frozen beet.

* * *

Examination of a twin-scroll DdS conntiuous diffuser at Ust'-Labinsk sugar factory. E. T. KOVAL', A. YA. ZAGORUL'KO, A. A. LIPETS and V. N. SHCHEGOLEV. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*,1960, **8**, 43–58.—Tests on a 1400 tons/day DdS diffuser are discussed. It was found that the diffuser is sensitive to the quality of the cossettes and that 7–8 mm Königsfeld cossettes are best, with a minimum Swedish number of 15–20 and maximum mush content of 3%, as produced with a slicing speed of 4–5 m/sec. The optimum cossette length was 9 m/100 g for fresh beet, reducing to 5–7 m/100 g according to quality. Because of considerable packing of the cossette throughout the diffuser, the minumum elasticity modulus of the cossette should be 4–8 kg/sq.cm. The temperature in the first quarter of the diffuser should be 50°C (above this, the cossette permeability falls), rising to 70–72°C in the 2nd and 3rd temperature zones, and dropping to 60–65°C in the last zone. Optimum juice draught was 120–125% at 17% sugar content, and optimum scroll speed 0·7 r.p.m. Extreme intermixing of cossettes occurred. Retention time at maximum rated throughput is 98–100 min. Cossette crushing occurred to the same extent as in the RT[1] and Buckau-Wolf diffusers (see previous abstract). With sterile diffusion water and maintenance of adequate temperatures, there is no bacterial activity in the diffuser. Pulp yield was 90% on weight of beet. Losses were 0·55% on weight of beet at a juice draught of 117·3% with cossettes 8·7 m/100 g long and a sugar content of 16·8%. Advantages of the diffuser are: ease of supervision and simplicity of construction; disadvantages include: damage to shafts and helices when synchronization is broken; drop in throughput and efficiency with stale and damaged beet; stoppages caused by juice flow into the head of the diffuser.

* * *

Statistical, biological and physico-chemical bases for the evaluation of the sugar beet. M. DRACHOVSKÁ and K. ŠANDERA. *Ind. Sacc. Ital.*, 1960, **53**, 139–152; 241–256.—See *I.S.J.*, 1959, **61**, 181.

* * *

Studies on the properties of the conveyor system of a single-column diffuser. I. I. PRILUTSKII. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 59–66.—Examination of the twin-scroll tower diffuser at Kshensk factory has revealed that the cossettes flow both in a vertical direction and spirally with the scroll blades. This affects the lower layers of the cossette-juice mixture. For normal conditions the scroll speed should be 0·2–0·6 m/sec or 0·16–0·3 m/sec with frozen beet. The maximum specific loading should be 60 kg/hectolitre. The diffuser has the following defects: high rate of cossette crushing; intermixing of cossettes and juice; interruption to juice-cossette flow by the counter-blades, which increase the subsidiary resistances and complicate erection and dismantling of the diffuser. The diffuser height can be reduced and its efficiency thus raised by replacing the continuous scroll blades with separate screen elements with minimum perforations of 15 × 15 mm.

* * *

An equation for the diffusion process and the value of the coefficient K_o. A. K. BURYMA. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 67–78.—Empirical logarithmic equations are presented for calculation of sugar losses in battery diffusers and are analysed. In these equations appears a theoretical coefficient K', which equals $K_o \times \eta$, where K_o is an empirical component having a value of $2{\cdot}3413 \times 10^{-12}$ and η is a general diffusion coefficient covering cossette diffusion surface, diffusion temperature and time, juice draught, etc. Worked examples are presented to show how losses in diffusion tailings are inversely proportional to cossette density, and a graph is drawn of this relationship, and of the juice coefficient of the beet *vs.* sugar losses (directly proportional). The juice coefficient is inversely proportional to K_o. Another factor (A) is introduced which is the battery daily throughput in tons of beet. A nomogram is drawn for determination of A and the correction factor K by which the losses should be multiplied for a "universal nomogram for battery diffusers" giving diffusion losses. While theoretically A does not depend on the diffuser design, in practice it is indirectly dependent on it because of the different ways in which the cossette surface is utilized. This is one of the main factors affecting values of K_o.

[1] *I.S.J.*, 1961, **63**, 214.

Study of purification processes and return of diffusion waters to diffusion at Nosovsk sugar factory. A. F. CHEKURDA and A. P. OLESHKO. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 127–151.—Two schemes for purification and return of diffusion and press-water, based on the results of factory tests, are described. One is intended for factories with battery diffusers, the other for those with continuous diffusers. They involve chlorination, heating, intermittent use of formaldehyde and mechanical filtration. The first scheme includes a Chekurda clarifier in which the diffusion water is pumped from below into an inverted bell-shaped diffusion chamber. The water rises at a reducing speed. Above the bell is a conical screen. Water passes down through the perforated sides of the cone and the pulp particles then act as a filter for further incoming diffusion water. Eventually the water pressure increases until the conical screen is lifted off the bell, allowing its contents to overflow into the sludge section of the clarifier. The overflow enters a second bell chamber surround the first, and passes to the bottom where it is finally forced out through screens into a third chamber surrounding the second. Sediment from the chambers is discharged to a waste pipe, water from the top of the third chamber going to the heater. A 95–99% purification efficiency is achieved, reducing the average BOD_5 by 23% and the bacterial content of the water by 10%. Diffusion was as normal and sugar losses were somewhat reduced. By introducing the new schemes, water consumption was cut as well as the amount of class III waste waters.

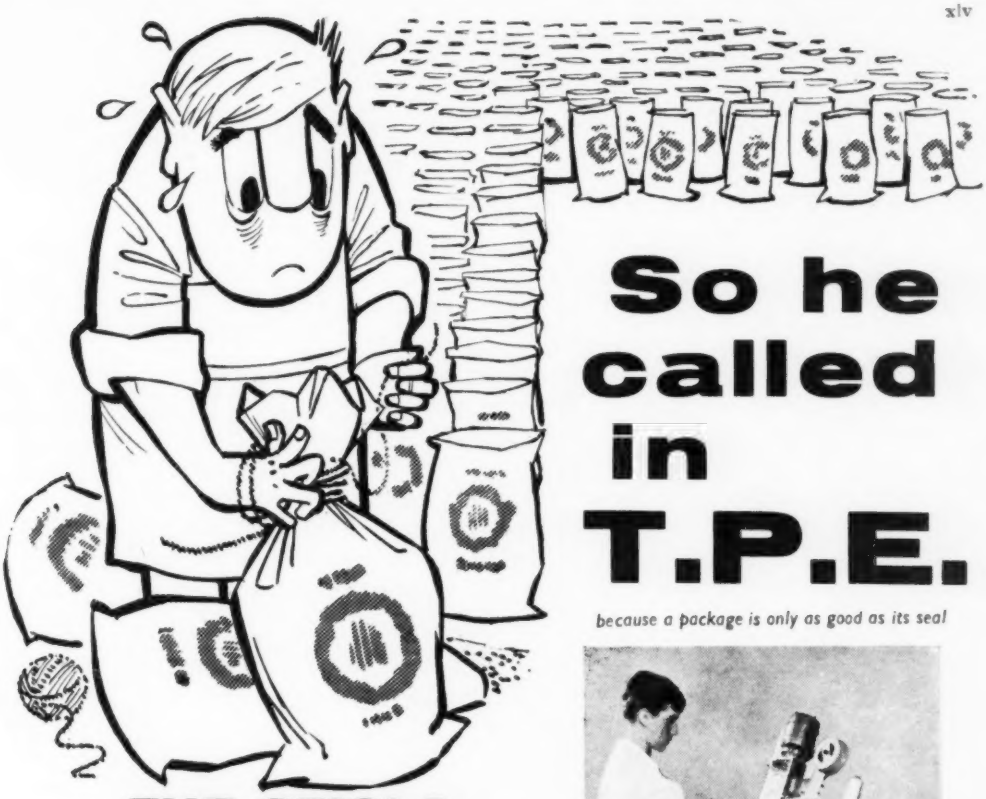
* * *

Examination of aeration methods of purifying highly concentrated sugar factory waste waters. A. F. CHEKURDA, A. P. PARKHOMETS, A. P. OLESHKO and M. S. KOZACHUK. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 152–173.—Full details are given of a test plant at Khodorovsk sugar factory where the class III waste waters had a BOD_5 of 1058–2548 mg/litre, i.e. an average of 3·6 times that of normal town sewage. The plant consists of aeration tanks in which diffusion water, press-water and filter muds are oxygenated after treatment in settling tanks and mixing with active sludge. The water then passes to a second settling tank. Full details are given of the aeration tanks and the regenerator for reactivation of the sludge and of the tests. A 90% purification efficiency was attained in the first settling tank, and the BOD_5 reduced by 21%. The oxygenation capacity of the regenerator was 817 g O_2 per cu.m./cu.m., the BOD_5 of the active sludge being reduced by 34% on average. At normal loading of the aeration tanks the oxygenation capacity was 1390 g O_2/cu.m./cu.m. on purified water and 1785 g O_2/cu.m./cu.m. on the mixture of purified water and active sludge, the BOD_5 of this mixture being reduced by 46% on average. The purification efficiency in the 2nd settling tank was 71·5% at an average flow rate of 1·78 mm/sec. The total drop in BOD_5 was 68%. There are 30 references to the literature.

The use of ion exchange resins in the sugar industry. N. N. KOSTENYUK and N. A. MAKSIMOVA. *Trudy Tsentr. Nauch.-Issled. Inst. Sakhar. Prom.*, 1960, **8**, 174–185.—A survey of the literature on ion-exchange processes in the sugar industry is given with 45 references. It is concluded that the classic scheme of treating cold 2nd carbonatation juice with cation and anion exchangers has many serious snags and that nowhere has 100% purification of 2nd carbonatation juice been achieved. Attempts to raise the efficiency of this scheme by modifying the regeneration methods lead to complications in the equipment and the schemes themselves. Even modifications of the classic scheme such as the reverse cycle and mixed-bed versions also have defects. This also applies to the use of cation exchangers on the Na cycle. The use of anion exchangers in Cl form for decolorizing refinery syrups has a number of advantages, in particular a higher efficiency than bone char or active carbon, producing a high quality crystal sugar and a colourless syrup for the confectionery trade.

* * *

Examination of the processes of plasmolysis and diffusion of beet cossettes in a single-column tower diffuser. I. I. PRILUTSKII. *Sakhar. Prom.*, 1961, (2), 21–26.—Laboratory and factory tests were carried out in which cossettes were passed through a pre-scalder and a main scalder 1–7 times at varying juice temperatures. The plasmolysis of fresh and frozen beet was studied at juice temperatures of 70–75°C. Juice concentration rose sharply in the initial stages, the maximum increase occurring in the first 4–5 min. Considerable plasmolysis occurs when the beet are sliced and the cell membrane ruptured and (in the case of frozen beet) as a result of the temperature effect. Cossettes 13–15 m/100 g long should be scalded with 300–350% juice of 88–90°C. For frozen cossettes (8–10 m/100 g long) the amount of juice should be reduced to 250–280% and the temperature to 85–86°C, and for severely frozen beet (6–10 m/100 g) the amount should be 200–250% at 82–85°C. The extent of plasmolysis will then be 90–96%, the process being completed at the bottom of the tower diffuser. The temperature of the juice–cossette mixture should be 76–87°C for fresh beet and 72–74°C for frozen and partially damaged beet. The sugar content of the cossettes in the pre-scalder was reduced by 0·8–1·0% and by 2–4% in the main scalder. The juice concentration rose very steeply when the juice–cossette mixture was 3–4 m deep in the scalder, although foaming when frozen and damaged beet are processed often makes this unpractical. Adding juice of the same temperature at various points to the cossettes flowing through the pre-scalder caused no change in the sugar extraction nor in the plasmolysis. On average 15–27% of the juice adhered to the cossettes. A graph is presented of diffusion in the tower diffuser at Kshensk factory, showing the increase in Brix and purity throughout the diffuser.



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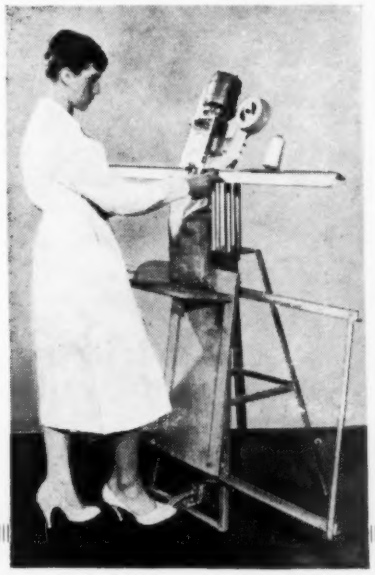

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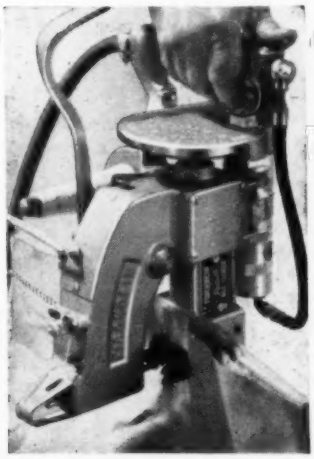

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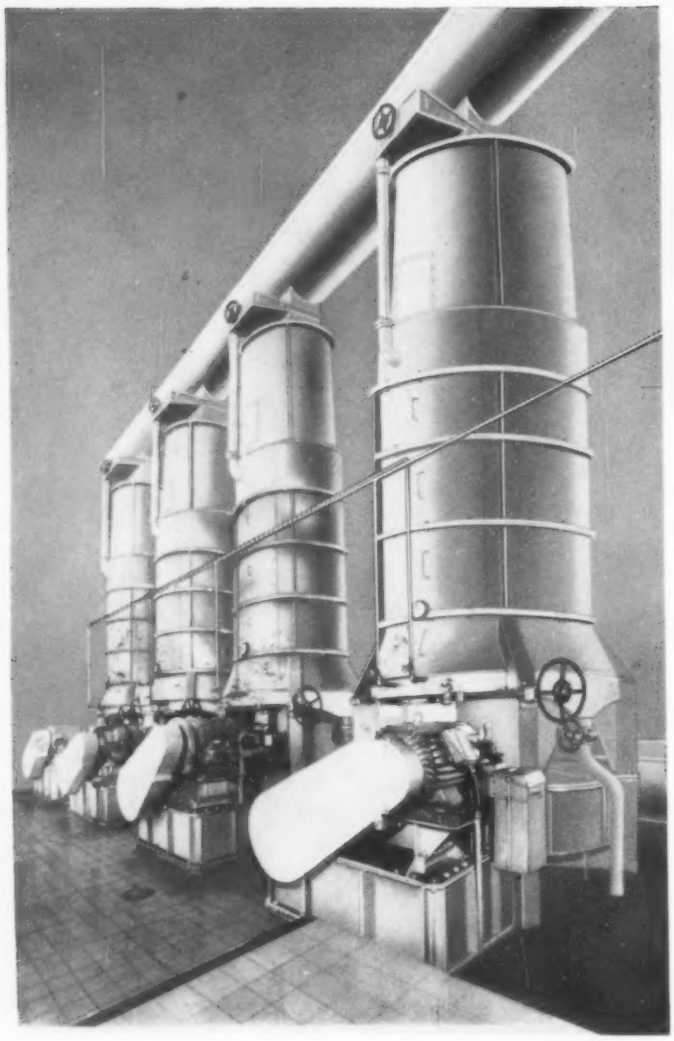

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LABORATORY METHODS AND CHEMICAL REPORTS

Average size, weight and number of crystals in sugars and massecuites. SIR JOHN SAINT and R. R. TROTT. *Sugar J.* (La.), 1960, **23,** (7), 23–27.—The Powers' method of reporting crystal size and uniformity[1] has been applied to several raw sugar sieve analyses, in which 7 g of sugar was washed with 15 ml 90% alcohol saturated with sugar at laboratory temperature. The commercial sugar crystals were transferred to Tyler sieves after two washings. The sieves were shaken gently for 30 min and after draining dried with their contents at 120°C during 20 min, cooled and weighed. Massecuites and *C* sugars (10 g) were first washed with 80% alcohol before the 90% alcohol: they were shaken for 1 hr. Results showed considerable difference between the weights of the average crystal from different sugar samples of the same sieve size, indicating similar differences in the average length of the crystals. Calculated values obtained by THIEME for the crystal weights based on crystal length measurements and volume are also tabulated. These agree well with the true weights, although the average crystal size determined microscopically may vary considerably from the mean aperture of the respective sieves. If the calculated weights are determined from the average sieve apertures, there is a marked difference between calculated and true weights. Counting the number of crystals in massecuite samples and determining directly the average weight of crystals gave results much closer to the weight and number of crystals calculated from Thieme's formula in the case of the larger grain sugars than with the smaller grain sugars; but the difference was sufficiently large for the formula to be considered unreliable. Powers' concept of M.A. and C.V. for grist analysis is therefore recommended as giving a clear mental picture of crystal size.

* * *

The solubility of sucrose in water. K. WAGNEROWSKI, D. DABROWSKA and C. DABROWSKI. *Gaz. Cukr.*, 1960, **62,** 357–360.—Refined crystal sugar is diluted with distilled water then hermetically sealed in a mixer located in an ultrathermostat at a temperature constant to ± 0·05°C. After 6 hr at 40–80°C the mother liquor was separated from the crystals by suction filtration through a silk cloth in two 40-ml (54 g) portions. The syrup was then cooled to a level sufficient to prevent any increase in concentration before being transferred to a 200-ml flask made up with water maintained at 20°C. The pol was then determined with a Schmidt & Haensch polarimeter. The 200-ml flask was previously weighed to establish correction factors for the polarization. The values of the sucrose solubility are tabulated together with those determined by HERTZFELD, GRUT and KAGANOV. They are in close agreement with these, but particularly with the Kaganov values. Empirical formulae are derived for sucrose solubility at 4 temperature ranges from 0 to 100°C from graphs showing *r* (sugar solubility) as a linear function of ln *t* (saturation temperature). Values calculated from these agree closely with Kaganov's values.

* * *

Iodometric determination of lactic acid in diffusion juice. A. ŠEPITKA and E. ZRADULOVÁ. *Listy Cukr.*, 1961, **77,** 16–20.—The lactic acid is isolated by passing the raw juice through "Wofatit L 150" anion exchange resin (2 g per 25 ml juice containing 0–100 mg lactic acid). The resin is washed with water and eluted with 2N NH_4OH solution. The ammonia is driven off from the eluate and the lactic acid remaining determined with iodine: a phosphate buffer of pH 7 is added to the solution with $NaHSO_3$ and 0·01N $KMnO_4$. The lactic acid is oxidized to acetaldehyde (which is converted into its bisulphite compound), the end of the reaction being marked by a brown coloration. After bringing to pH 2–3 with HCl, the solution is titrated with 0·1N iodine using starch indicator. Excess iodine is removed with sodium thiosulphate and the free acetaldehyde distilled off into a known volume of standard $NaHSO_3$. Excess bisulphite is titrated with iodine. The lactic acid determined was 1% lower than the true amount. A nomogram shows the amount of lactic acid per 100 g juice solids, in which the error is eliminated.

* * *

Non-enzymic browning in foods. The mechanism of sugar-organic acid system. J. R. IYENGAR and N. S. KAPUR. *Food Sci. Mysore*, 1960, **9,** 124–126; through *J. Sci. Food Agric. Abs.*, 1961, **12,** i–91.—Sucrose and citric acid (present in most fruit products) were refluxed in 12 varying proportions. In samples taken at intervals of 12 hr, pH, titratable acidity, optical density at 420, 490 and 530 mμ and optical density at peak positions in the region 250 to 300 mμ were determined. The pH of the solution containing decimolar concentration of sugar and citric acid decreased from 2·68 to 2·50 during 10 hr refluxing. When the proportion of acid to sugar was increased, the drop in pH also increased; when the sugar:acid ratio was increased, the drop in pH decreased. Browning reaches its maximum after 8 hr of refluxing in solutions containing equimolar proportions of sugar and acid. Decimolar solutions did not show appreciable browning.

* * *

Determination of the sugar content in molasses at its standard purity. T. P. KHVALKOVSKII. *Sakhar. Prom.*, 1961, (2), 16.—The formula derived by AKINDINOV[2] is simple and accurate; for this reason the formula presented by TVERDOKHLEBOV[3] is considered super-

[1] *I.S.J.*, 1948, **50,** 149.
[2] *I.S.J.*, 1960, **62,** 224.
[3] *I.S.J.*, 1961, **63,** 21.

fluous as well as being erroneous. The corrected form is $M_s = M_1 \frac{85 - x}{85}$, where M_s = molasses yield per 100 kg beet at standard purity, M = actual molasses yield per 100 kg beet, and x = amount of crystal sugar per 100 kg of the original molasses converted to standard purity.

* * *

Determination of the sugar content in carbonatation muds. I. VAVRA and A. VAVRA. *Zeitsch. Zuckerind.*, 1961, **86**, 128–135.—The defects in the standard method of determining the sugar content of carbonatation muds are discussed. The main fault lies in the procedure for withdrawal of the sample, although another source of error is the assumption of a dry solids content of filter press muds of 50%, while the true value is 45% and often less. Thus the determined values are often lower than the true values, the difference increasing with increase in the dilution. Three versions of a new method are described, all based on dilution of a homogenised sample after drying to constant weight at 105°C, standard polarization, and multiplication of the polarimeter reading by a variable dependent on the s.g. and thus the dilution of the muds solution. The result is based on a muds of 50% dry solids. While all three methods give identical results, the following is recommended as the fastest: 300 g of the diluted sample weighing approximately 108–114 g/100 ml is sieved, and 100 ml weighed after separation of any foam which may have formed. The factor f is then read from a table of weights in the range 103–116 g. The solution is clarified with 10 ml $ZnCl_2$ solution (300 g $ZnCl_2$/litre) and the pol determined.

* * *

Non-sucrose constituents in raw sugar crystal. I. Relationship between non-sucrose constituents and crystal size. K. ONNA and C. C. TU. *Hawaiian Planters' Record*, 1961, **56**, 155–160.—Ten-pound samples of raw sugar crystals were mixed with 4 litres of methanol by shaking every 5 min for ½ hr. The MeOH was filtered off through a 100-mesh screen and the operation repeated once with MeOH and again with *iso*-propanol. After oven-drying of the sugar at 80–90°C for 3½ hr, 1-lb portions were separated into grist fractions with a "Ro-tap" screening machine, and the crystals washed 4 times by mingling with 67° Bx granulated sugar solution, rinsed with MeOH, air-dried and stored in sealed bottles. Crystal colour was determined by dissolving 40 g in 100 ml water, adjusting to pH 7 and filtering with the addition of 1 g filter aid, thereafter measuring the attenuation index at 420 mμ using a Beckman spectrophotometer. The specific conductance was determined after dissolving 10 g sugar in 200 ml water. Aqueous methanol-insolubles were measured by boiling 225 g sugar under reflux in 1 litre of 85% methanol (v/v), centrifuging after 2 hr, and washing the insolubles in acetone and ether before drying. Results show that crystal colour, conductivity and insolubles decreased with crystal size, and that the larger crystal fractions were more highly coloured than the smaller ones.

Non-sucrose constituents in raw sugar crystal. II. Classification of colour substances. C. C. TU and R. H. OKAMOTO. *Hawaiian Planters' Record*, 1961, **56**, 161–167.—Paper chromatography and paper electrophoresis were used to isolate colour bodies from raw sugar crystal. The raw sugar was dissolved in 85% methanol, insolubles removed by centrifuging, and sucrose crystallized. The mother liquor was concentrated and MeOH added whereupon further sucrose crystallized. After repeating this, the final coloured methanol solution was transferred to a cellulose column and eluted with ethyl acetate:acetic acid:water (6:3:2 v/v) in 5 ml fractions. Of 96 fractions, fractions 33–46 contained the naturally occurring flavonoid plant pigments and fractions 60–80 sugar degradation products. Paper electrophoresis of the syrup from the final sucrose crystallization revealed charged brown and yellow bands migrating towards the anode. The yellow band was resolved into 5 bands, fluorescent under U.-V. light. A positively charged brown band migrated towards the cathodes and gradually disappeared as two substances appeared—one reactive to ninhydrin, the other heat-sensitive. Two amino acid groups were also isolated, and were mainly composed of aspartic and glutamic acid. In a study of sugar degradation, glucose and fructose (25 g) were mixed with 20 g $Ca(OH)_2$ in 500 ml water, and maintained for 16 days at room temperature. The solution turned brown. Excess $Ca(OH)_2$ was filtered-off and the filtrate evaporated to 400 ml. Residual Ca was removed by ion-exchange, and the resultant syrup thickened. Another 12 g of fructose was mixed with 10 g $Ca(OH)_2$ in 250 ml water, and maintained for 18 days at room temperature. A yellowish-brown colour resulted, and the solution was treated as above. Chromatographic and electrophoretic studies indicated the presence of several organic acids in the degradation products, and during electrophoresis in alkaline medium, two coloured bands separated, that migrating towards the cathode gradually disappearing. Five samples of 20 g of glucose, fructose, and sucrose were heated at 110°C and the colour change noted at intervals. Results of chromatographic determination of the degradation products are tabulated. Electrophoresis of the fructose thermal degradation products indicated that they consist of two groups of brown substances migrating in opposite directions in an electric field. Although separate from each other, they did not change colour.

* * *

The iodometric method of invert sugar determination using Fehling-Müller's solution. W. SCHIEBEL. *Zucker*, 1961, **14**, 168–171.—Experiments on raw beet sugar samples, in which the invert sugar was determined iodometrically with Müller's solution, have revealed fluctuations in the values after 5 and after 15 min standing, corresponding to a difference of ± 0·01% invert. Light was found to have the same quantitative effect on the results as time. To remove the error, identical time and lighting conditions must be applied to determination of both the "hot" and the "cold" values.

BY-PRODUCTS

Sugars, raw material for a new branch of the chemical industry. D. KORF. *Chem. Weekbl.*, 1960, **56,** 686–690; through *S.I.A.*, 1960, **22,** Abs. 1242.—A survey with 49 references is given of the applications of sucrose as a chemical raw material for the production of lactic and other organic acids (levulinic acid, etc.), hexitols, glycerol and propanediol by catalytic hydrogenation, allylsucrose and ethers and esters of sucrose, etc.

* * *

A comparative study of the holocellulose in bagasse of different cane varieties. A. AMARAL and E. RAMOS. *Instituto Cubano de Investigaciones Tecnológicas, Serie de Estudios sobre Trabajos de Investigación*, 1959, (8), 71 pp; through *S.I.A.*, 1960, **22,** Abs. 1283.—Holocellulose (α-, β- and γ-cellulose) was separated from bagasse from different cane varieties (Co 281, Co 290, POJ 2878, ML 3-18 and PPQK) at different growth stages (6–18 months). The contents of lignin, pentosans, ash, SiO_2, Fe and Mn in the remaining material were also determined. The average degree of polymerization of the cellulose was calculated from the viscosity of the fractionated nitrated cellulose solution, and graphs are given of the frequency and mass distribution of the different polymers from each cane variety. The methods of analysis used are described fully and the results are presented in diagrams and tables. The overall average degree of polymerization was 1000–1100, lower than that of pine or beech wood cellulose. The Co varieties showed the highest degree of polymerization. No relation was found in the different varieties between cellulose unhomogeneity and age. The differences in analytical results for bagasse cellulose suggest that differences in cane variety should be considered when investigating the utilization of bagasse.

* * *

Sucrose as an industrial raw material. H. SCHIWECK. *Zucker*, 1961, **14,** 114–121; 142–149.—A survey is presented of the historical developments and present international state of research in sucro-chemistry. The potentialities of sucrose utilization in the chemical industry are also discussed.

* * *

Net energy of blackstrap molasses for fattening steers as determined by a comparative slaughter technique. G. F. LOFGREEN and K. K. OTAGAKI. *J. Anim. Sci.*, 1960, **19,** 392–403; through *J. Sci. Food Agric. Abs.*, 1961, **12,** i–133.—Molasses was added at rates of 10, 25 or 40% to fattening ration for steers. The 10% rate increased fat deposition without appreciable increase in rate of gain in live-weight. The higher proportions of molasses diminished both fat deposition and rate of gain in weight as compared with the basal ration. With rise in amounts of molasses fed the experimentally determined total digestible nutrient and digestible energy of the ration declined somewhat (5–8%); the net energy decreased markedly (up to 50%).

Storage of mixed feeds containing cane final molasses, 1. Effect on chick growth and feed utilization. E. ROSS. *Poultry Sci.*, 1960, **39,** 985–993; through *J. Sci. Food Agric. Abs.*, 1961, **12,** i–136.—A maize-soya bean oil-meal diet showed little loss in nutritive value (as measured by weight gains and feed efficiency of chicks) during storage for 9 months. When mixed with 15% of cane final molasses, the nutritive value decreased slightly after 7 months' storage. When mixed with 30% of cane final molasses the nutritive value decreased considerably after 5 months' storage.

* * *

Effect of water restriction on chicks fed different levels of molasses. E. ROSS. *Poultry Sci.*, 1960, **39,** 999–1002; through *J. Sci. Food Agric. Abs.*, 1961, **12,** i–136.—Restricting the water intake of chicks to three 30-min periods per day resulted in reduced weight gains and feed consumption to 6 weeks of age in comparison with chicks receiving water *ad lib.* The extent of the reduction due to water restriction increased with level of molasses (15–30%) in the diet. Restricting water with the no-molasses or 15% molasses feeds had little effect on total water consumption, but increased the moisture content of the droppings; with the 30% molasses diet restriction lowered the total water consumption, but had no effect on the moisture content of the droppings.

* * *

The progress of the TSC depithing project. S. H. WU. *Taiwan Sugar*, 1961, **7,** (12), 17–18.—At Chihu mill, near Changhwa hardboard plant, bagasse depithed by 10 gyratory screens still contained over 20% pith. By using more screens and an attrition mill, the pith content was reduced to below 4%, while a boiler with a spreader stoker for burning of the pith was also installed. Production of depithed bagasse was at the rate of 1½ tons/hr from a daily total of 700 tons of green bagasse. The pith yielded 10% CO_2 in combustion.

* * *

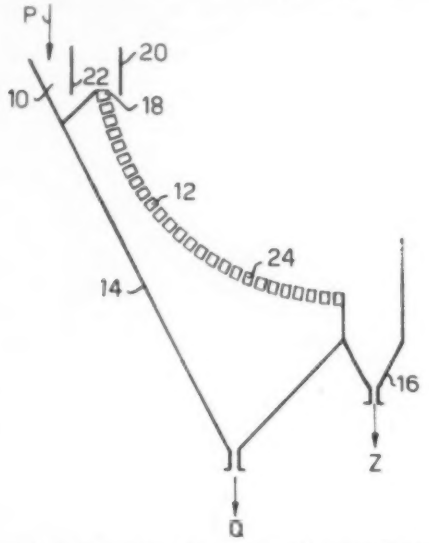
Manufacture of glucose syrup from molasses. A. ARELLANO CASSANI. *Bol. Azucar. Mexicano*, 1960, (June), 31–33; through *S.I.A.*, 1961, **23,** Abs. 29.—Invert sugar syrup can be manufactured by diluting final molasses and submitting it to lime-phosphoric acid purification and cation and anion exchange treatment, with subsequent inversion with acid; alternatively, the Steffen process, also followed by acid inversion, or a treatment of the diluted molasses with sulphuric acid, and then with phosphoric acid, may be used. The processing of maize to starch and syrup is also described.

* * *

Useful application of molasses. ANON. *Bol. Azucar. Mexicano*, 1960, (June), 34–35; through *S.I.A.*, 1961, **23,** Abs. 30.—A survey lists preparations from molasses, including both chemicals (ethanol, acetic acid, ethyl acetate, *n*-butanol, methyl acetate, butyl acetate, ether) and yeasts (baker's yeast, dried yeast and food yeasts) and indicates the possible yields.

UNITED STATES

Screen (for cane juice, etc.). F. J. FONTEIN and H. H. DREISSEN, *assrs.* STAMICARBON N.V., of Heerlen, Netherlands. **2,872,041.** 14th December 1954; 3rd February 1959.—A supply of liquid containing suspended solid particles *P* is passed into the overflow reservoir 10 flow onto the screen deck 12 being



governed by the plate 20. The liquid passes through gap 18 onto the deck 12 which is formed by a series of spaced bars 24 extending in the plane of the drawing and providing a concave surface interrupted by slits. The liquid and particles up to half the width of the slit in diameter will pass through the slits into reservoir 14 while the coarser particles are carried along the deck and collected by funnel 16.

* * *

Production of citric acid by fermentation. S. KONISHITA, K. TANAKA and S. AKITA, *assrs.* KYOWA HAKKO KOGYO K.K., of Tokyo, Japan. **2,973,303.** 23rd July 1958; 28th February 1961.—A micro-organism, of the class consisting of *Penicillium janthinellum* Biourge var. *kuensanii* Kinoshita, Tanaka and Akita and *P. restrictum* Gilman and Abbott var. *kuensanii* Kinoshita, Tanaka and Akita, is cultivated in an aqueous medium containing untreated sugar material (blackstrap molasses, beet molasses or raw sugar), nitrogen source and inorganic salts under submerged conditions whereby citric acid is produced in the medium from which it is recovered. The aqueous medium contains sufficient $CaCO_3$ to adjust its pH to about 6 during the fermentation. The sugar source contains the equivalent of 15–20% by weight of glucose on total weight of culture medium.

* * *

Beet harvesters. C. VAN DER LELY and A. VAN DER LELY, of Maarland, Holland, *assrs.* C. VAN DER LELY N.V. **2,973,816.** 5th November, 1956; 7th March 1961.

* * *

Cane combine (harvester). S. A. THORNTON, *assr.* S. A. THORNTON, Jr., of Alexandria, La., U.S.A. **2,974,464.** 16th December 1957; 14th March 1961.

* * *

Purifying beet diffusion juice. P. W. ALSTON, of Berkeley, Calif., U.S.A. **2,976,189.** 12th December 1955; 21st March 1961.—Diffusion juice is treated (at $< 70^{\circ}C$) with lime in increments at intervals of at least 1 min until 0·3–0·6% by weight on beet has been added and a precipitate formed (at pH 10·8–11·6), gently stirring at a rate insufficient to break up the curds of precipitate, and heating to a temperature below the b.p. (70–90°C), followed by filtering so as to separate the precipitated impurities before introduction of (a further 1·5% CaO and) CO_2 and separation of the 2nd precipitate formed which contains additional impurities. Samples of the juice are withdrawn and increments of lime added and the filtration rates measured, lime being added to the main amount of juice as above until that amount giving the maximum filtration rate has been added.

* * *

Purification of sugar-containing (beet or cane) juices. A. R. GRANDADAM, *assr.* SOC. INDUSTRIELLE ET AGRICOLE DE LA SOMME ET RAFFINERIE FRANÇOIS, of Paris, France. **2,977,253.** 12th March 1958; 28th March 1961.—Raw juice is treated with lime at a constant flow rate and CO_2 at a variable flow rate, so as to produce a $CaCO_3$ precipitate adsorbing the flocculated impurities, SO_2 being introduced at a constant flow rate to promote this precipitation, and also precipitate $CaCO_3$, this SO_2 flow rate (4–20 g/100 litres) being substantially lower than the CaO flow rate (300–600 g/100 litres), the CO_2 flow rate being adjusted to bring the pH of the raw juice (6) to the optimum (11) ($\simeq$0·8–1·2 g/litres alkalinity). The juice is filtered, more lime and CO_2 added and a further precipitate obtained which is separated and added to the raw juice to aid the initial precipitate formation. The SO_2 flow rate may be controlled so as virtually not to affect the pH.

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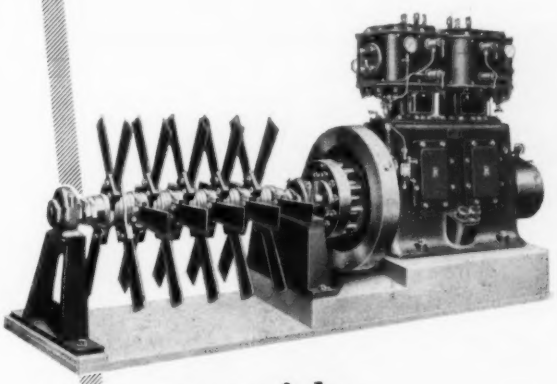

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"Abolit", an organo-boron-based fungicidal product, is intended for surface treatment of walls and ceilings in establishments where sugar is used in process; it acts by immobilising the functional substances of yeasts and bacteria and is non-toxic, odourless and permanently active.

* * *

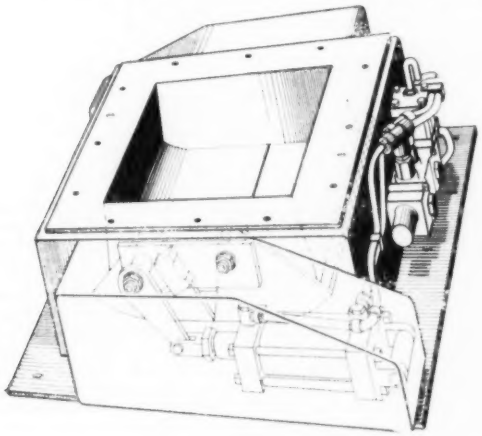
Industrial electronic weighing. Rotax Ltd. (Process Control Group), Chase Road, London, N.W.10.

A new range of electronic weighing equipment is provided with a full engineering service to cover design and installation of complete systems including instrumentation and associated steel structures. Weight indication can be given on a visual dial indicator, a full numerical digit indicator or digital display. Weight recording can be given using a pen recorder or made digitally, with print-out on a ticket or tape. Combinations of these can be supplied if required and equipment can also be produded to drive teletype and punch card accounting equipment. Provision can be made to integrate the system into process control schemes. It is particularly adaptable for use in batch weighing, tank and hopper weighing, crane weighing and weighbridge systems. One of its outstanding advantages is its robustness and ability to operate under severe conditions.

* * *

Heavy duty clamshell shutter gate. Lindars Automation Ltd., 143 Maple Road, Surbiton, Surrey.

The new pneumatically operated bin outlet illustrated has been designed for the control of heavy materials from bins and hoppers. It is in the form of a heavy duty clamshell shutter gate which, while allowing a free flow to the material being discharged, has a positive action when closing which completely cuts off the material without the risk of jamming, even when handling large sized pieces of irregular shape. It is of robust construction in mild steel and all the operating mechanism is protected from dust and from contact with the material being handled, as it is placed outside the shutter gate body. This arrangement further ensures that all parts requiring maintenance are readily accessible. The valves may be worked electrically or manually and a series of shutter gates can be arranged for automatic operation by remote control, if necessary in a given sequence. Sealing strips to prevent air leakage can be fitted as an optional extra. Six standard sizes are available with openings ranging from 4½ in × 4½ in to 18 in × 18 in.



* * *

The DSM screen for cane juices. Dorr-Oliver Inc., Cane Sugar Divn., 77 Havemeyer Lane, Stamford, Conn., U.S.A.

The Dorr-Oliver DSM screen is described in Bulletin 2300 and embodies the principles patented originally by a branch of the Dutch State Mines[1]. Juice enters through an inlet pipe into a feed box mounted over the screen and is delivered by means of a feed spout across the width of the screen deck. This consists of a series of wedge-shaped bars held by clamped retainers in a frame so that they form a concave surface interrupted by horizontal slats which open out in the direction of the rear of the deck. Juice passes through the slits and so into a reservoir from which it is discharged. Solid particles are retained by the screen and pass down and off the screen deck to a discharge apron.

The screens are available in 1, 2, 3 and 4-ft widths, the height being the same for each, and multiple feed pipes being fitted to the larger two sizes. The wedge bars forming the screen deck are of stainless steel. Features of the design are high capacity, high efficiency, simple installation and economy. The screen has found successful application in removal of bagacillo from cane juice and is also being used for secondary screening and polishing of clarifier overflow.

* * *

Magnetic separator with a ceramic magnet. Rapid Magnetic Limited, Lombard Street, Birmingham.

The new range of "Andox 5" permanent magnet pulleys for extracting tramp iron from processed materials includes magnets made of the revolutionary anisotropic barium ferrite ceramic material, whose

[1] U.S.P. 2,872,041 ; *I.S.J.*, 1961, **63**, 252.

exceptional coercivity permits a radial pole construction as distinct from the axial disposition adopted with "Alcomax" magnets. The superior field intensities so produced are equivalent to those of electromagnetic designs, with flux distribution patterned to conform to the burden contour on the belt conveyor. Highest intensity occurs at the centre of the conveyor where burden depth is greatest. Possessing unusual pulling and holding power and using stainless steel covers for long mechanical life, the pulleys are available in a range of sizes from 12 in to 24 in diameter for any belt width. Permanence is guaranteed for the life of the installation.

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crop wheels, while at the front are single or double (optional) 400-12 wheels. The weight is approximately 17 cwt, and by obviating the need for crown wheel and pinion transmission, it has been possible to obtain a minimum ground clearance of 17 in (to differential). Standard equipment will include hydraulic lift operation, and a hydraulic motor providing p.t-o tapping at any position on the chassis.

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Cuba to adopt the metric system[1].—The Cuban Government has announced that it intends to convert all weights and measures to the metric system during the current year.

* * *

Sugar Technology Institute for India[2].—The Government of India has given final approval for establishment of India's second sugar technology institute at Shrirampur in Maharashtra, for which the Government is to contribute about 2 crores of rupees (£1,500,000).

* * *

New rum distillery for Hawaii[3].—Seagram & Son, the largest distillers in the world, are to build a rum distillery at a cost of $500,000, located beside the Puunene mill of Hawaiian Commercial & Sugar Co. The rum will be sold in Hawaii and eventually in the U.S. Mainland.

* * *

Ghana sugar factory from Czechoslovakia[4].—Under the terms of a new trade agreement between Czechoslovakia and Ghana, the former will build a complete sugar factory in Ghana. The factory, built by Skoda, is to cost £G1½ million[5] and will be built at Awudome in the Volta region, starting operations by the end of 1963. It will process cane supplied by a local cooperative society and is expected to produce 100 tons of sugar per day.

Cuban sugar for Norway[6].—After protracted negotiations, 17,000 tons of Cuban raws have recently been acquired by Norwegian buyers in exchange for fish and other Norwegian goods. The sugar will probably be shipped to the U.K. where it will be refined before being imported into Norway.

* * *

U.S. sugar production, 1960[7].—Production of sugar from beet and cane during 1960 amounted to 2,455,000 short tons, raw value, and 630,000 tons respectively, according to the U.S. Dept. of Agriculture. In the previous campaign the production from beet was 2,340,000 tons and from cane 616,000 tons.

* * *

Bolivian sugar factory development[8].—A $1,750,000 loan made by the Development Loan Fund of the U.S. Government to Soc. Industrial Azucarera La Esperanza will enable it to treble the crushing capacity of its sugar factory, carry out land development work, expand by-product operation capacity, etc. The bulk of the loan will be spent on industrial and agricultural equipment, all imported items to be procured in the U.S.A.

* * *

European sugar beet area.—F. O. Licht's second estimates[9] of sowings for the 1961/62 campaign are reproduced below; they show little change from the estimates of the end of April.[10] The principal changes are increases of 20,000 and 10,000 hectares for France and Poland, while the West German figure shows a reduction for 10,000 hectares.

Hectares	1961/62		1960/61
Western Europe	*2nd est.*	*1st est.*	
Western Germany*	265,000	275,000	299,198
Austria	37,100	37,100	44,336
France	320,270	300,000	373,000
Belgium	67,000	65,900	67,221
Netherlands	85,000	87,000	92,513
Denmark†	35,200	35,200	50,104
Sweden	50,560	50,600	50,652
Italy	235,000	230,000	239,000
Spain	180,000	180,000	175,000
Yugoslavia	73,500	80,000	70,700
Switzerland	5,300	5,300	5,323
U.K.	167,331	168,500	168,031
Ireland	31,500	31,500	27,338
Finland*	17,500	17,000	15,226
Turkey	134,263	135,000	202,902
Total	1,704,524	1,698,100	1,880,544
Eastern Europe			
Eastern Germany	240,000	240,000	238,000
Czechoslovakia	245,000	245,000	241,000
Hungary	130,000	135,000	132,100
Poland	420,000	410,000	400,700
Albania	6,000	—	5,600
Roumania	215,000	215,000	210,000
Bulgaria	75,000	75,000	75,000
U.S.S.R.	3,300,000	3,300,000	3,056,000
Total	4,631,000	4,620,000	4,358,400
Grand Total	6,335,524	6,318,100	6,238,944

* Excluding area for beet grown in other countries.
† Including area for beet grown for export.

Stock Exchange Quotations

CLOSING MIDDLE

London Stocks (*at 17th July*, 1961)	
Anglo-Ceylon (5s)	13/3
Antigua Sugar Factory (£1)	10/–
Booker Bros. (10s)	25/3
British Sugar Corp. Ltd. (£1)	26/3
Caroni Ord. (2s)	4/1½
Caroni 6% Cum. Pref. (£1)	12/6
Distillers Co. Ltd. (10s units)	33/–
Gledhow Chaka's Kraal (£1)	30/–
Hulett & Sons (R1)	8/6
Jamaica Sugar Estates Ltd. (5s units)	4/1½
Leach's Argentine (10s units)	23/–
Manbré & Garton Ltd. (10s)	42/–
Reynolds Bros. (£1)	28/9
St. Kitts (London) Ltd. (£1)	17/6
Ste. Madeleine (Ord.) (£1)	27/6
Sena Sugar Estates Ltd. (10s)	8/9
Tate & Lyle Ltd. (£1)	43/–
Tate & Lyle Investments Ltd. (5s)	14/–
Trinidad Sugar (5s stock units)	39/6
United Molasses (10s stock units)	30/9
West Indies Sugar Co. Ltd. (£1)	15/6

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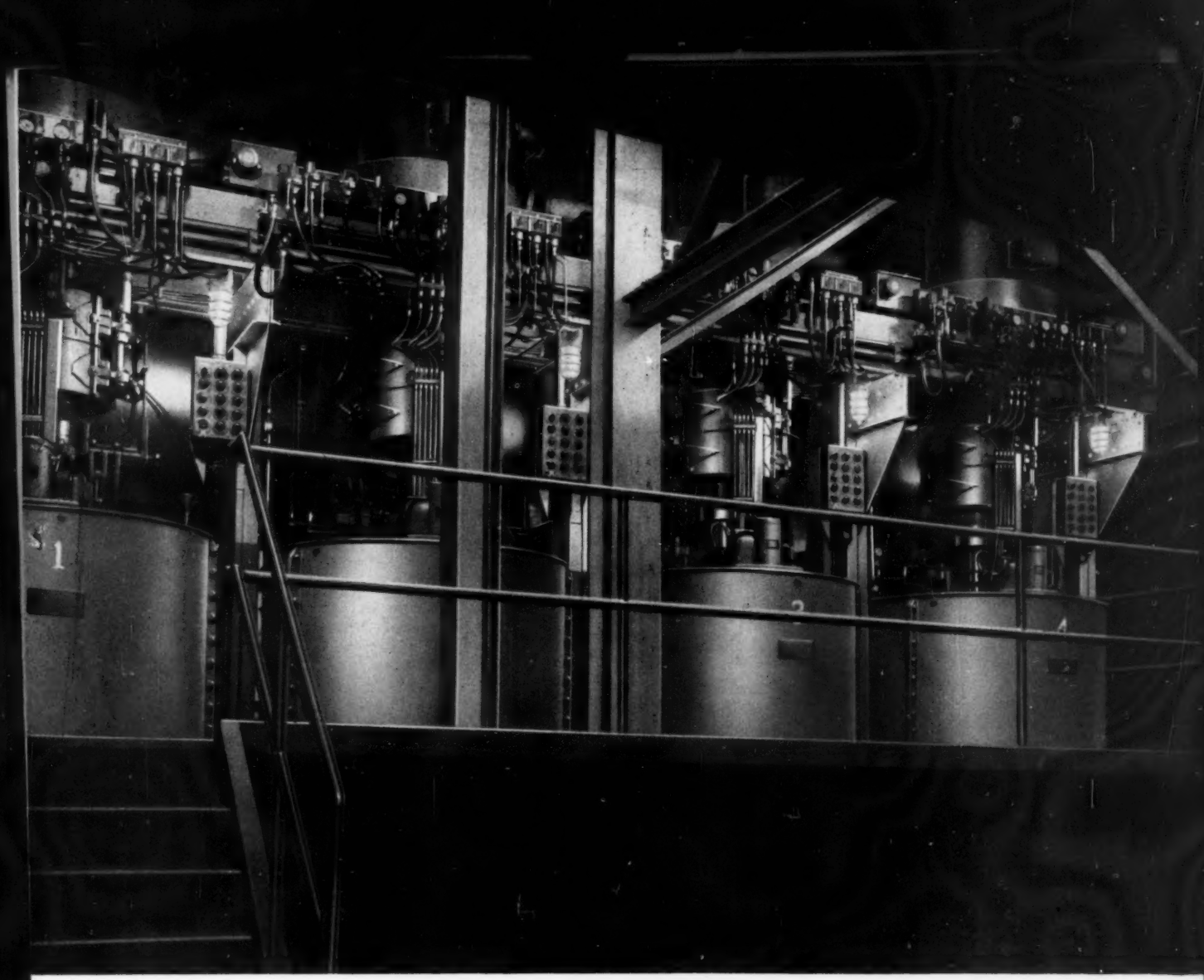
Central Aguirre ($5)	27
Cuban American ($10)	17¼
Great Western Sugar Co.	37⅝
South P.R. Sugar Co.	22¾
United Fruit Co.	27¼

[1] F. O. Licht, *International Sugar Report*, 1961, **93**, (Supp. 8), 103.
[2] *Indian Sugar*, 1961, **10**, 748.
[3] *Sugar y Azúcar*, 1961, **56**, (6), 60.
[4] F. O. Licht, *International Sugar Report*, 1961, **93**, (5), 98.
[5] *Overseas Review* (Barclays D.C.O.), July 1961, 63.
[6] C. Czarnikow Ltd., *Sugar Review*, 1961, (513), 113.
[7] C. Czarnikow Ltd., *Sugar Review*, 1961, (513), 114.
[8] *Willett & Gray*, 1961, **85**, 256.
[9] *International Sugar Report*, 1961, **93**, (6), 99.
[10] *I.S.J.*, 1961, **63**, 192.



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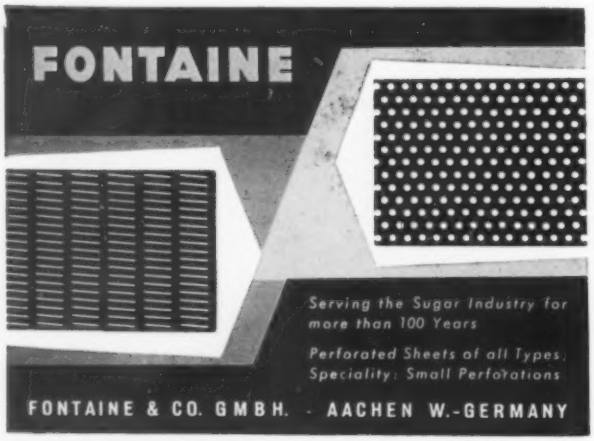
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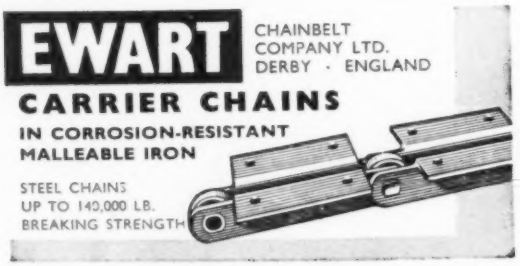

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The Ministry of Commerce, Industry and Supply of the Republic of the Sudan invites applications for the following posts in the new Sugar Factory:

(*a*) Chief Chemist (Sugar processing)
(*b*) Shift Chemists
(*c*) Chemical Engineer
(*d*) Mechanical Engineers (Shift Engineers)
(*e*) Mechanical Engineer (Boilers)
(*f*) Mechanical Engineer (Workshop)
(*g*) Electrical Engineer

Candidates for the above posts must hold an appropriate University Degree or equivalent qualifications, and have had at least three years' experience in a similar capacity in a Sugar Factory. Candidates should be not over 40 years of age and should be fit to work in the Tropics.

Appointment will be on short term contract (without bonus) for a period of three years, to be extended to five years if necessary.

Salary for post (*a*) will be in the range £S.2180–2400 and for posts (*b*) to (*g*) £S.1146–1786. Starting salary will be determined according to age. qualifications and experience. In addition a cost of living allowance, which is reviewed every two months, is payable, and an outfit allowance of £S.50 is payable when the contract is signed. There is no income tax in the Sudan at present). (£S.1 = £1. 0s. 6d.).

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Application should be made in writing, giving details of age, qualifications and experience, to the Appointments Section, Sudan Embassy, 3 Cleveland Row, St. James's, London, S.W.1.

Closing date: 15th August 1961.

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The Ministry of Commerce, Industry and Supply of the Republic of the Sudan invites applications from those suitably qualified to fill the post of Factory Manager in the new Sugar Factory.

Applicants must hold University Degree in Mechanical or Chemical Engineering (or equivalent qualifications) with at least five years' experience in a similar position. They must be fit to work in the Tropics. Age limit 55 years.

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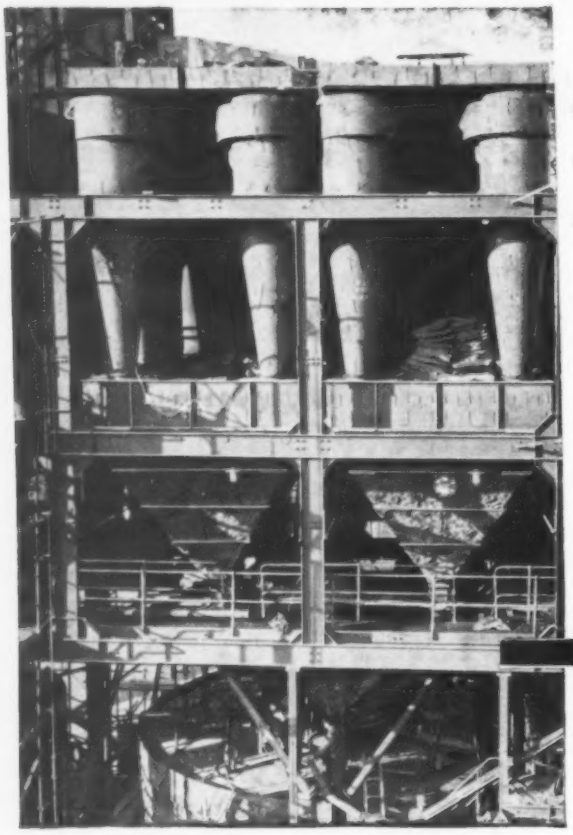

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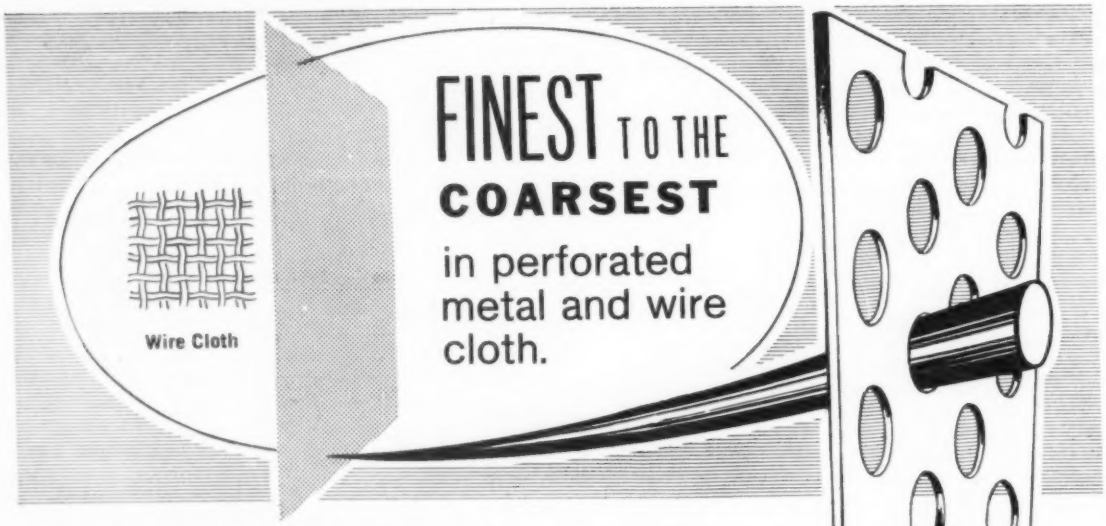

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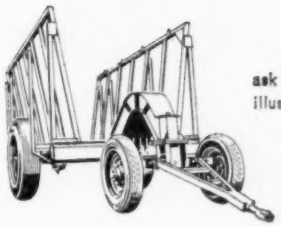

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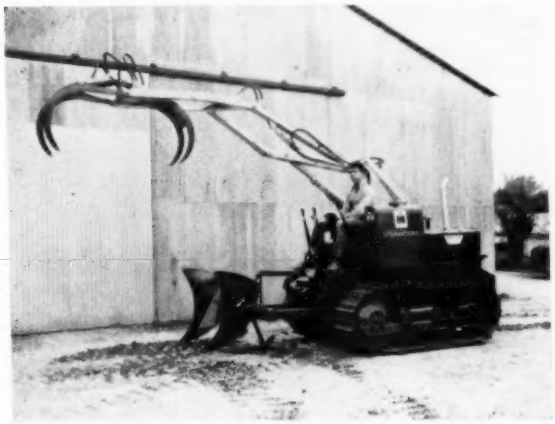

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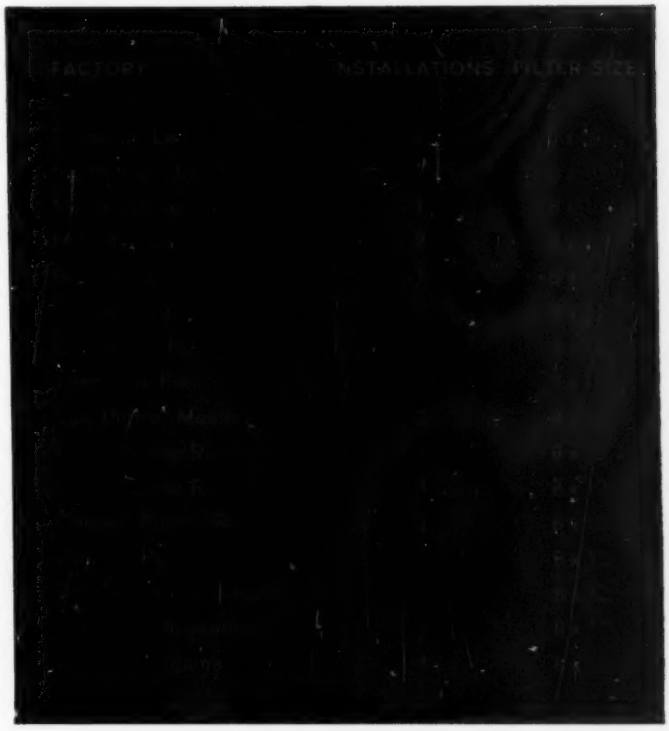

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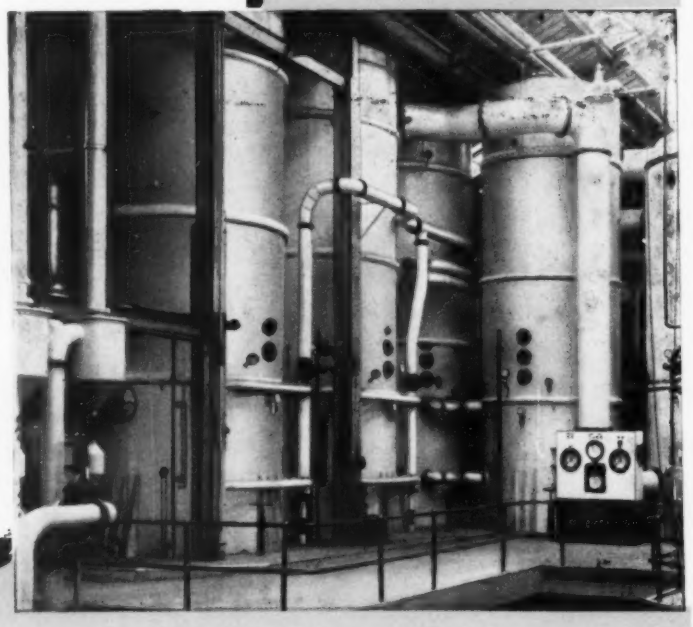

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